

TERRA

THE NATURAL HISTORY MUSEUM OF LOS ANGELES COUNTY

VOL. 26, NO. 6 • JULY/AUGUST 1988



King Herod's
Dream

MUSEUM ON THE MOVE

Five New Members Named to Natural History Museum Foundation Boards.

William M. Marcussen, James H. Cheney, Joseph Ryan, Frank G. Wells, and Sheldon Richman have recently been elected to Natural History Museum boards. Marcussen has been appointed by Los Angeles County Supervisor Peter F. Schabarum to the Natural History Museum Foundation Board of Governors. By virtue of this appointment, Marcussen also joins the Foundation Board of Trustees. Cheney, Ryan, Wells, and Richman have been elected to the Board of Trustees. Governors and trustees of the Natural History Museum provide direction for the museum's long-range programs and oversight for its operations. As community leaders, they form a bridge between the southern California public and the museum.

William M. Marcussen is president of The Marcussen Group, Inc., a consulting firm that provides assistance in communications and marketing management. He formed his own company after thirty-five years with ARCO, where he served most recently as vice president and assistant to the president. An active supporter of public education, Marcussen is currently a member of the Association of California School Administrators' Commission on Public School Administration and Leadership and outreach consultant for the University of Southern California. He serves on the Board of the Los Angeles Educational Partnership and the executive committees of the Los Angeles Area Chamber of Commerce and Cities In Schools.

James H. Cheney is vice chairman of Community Bank and chairman of the Executive Committee of the bank's Board of Directors. He was previously senior vice president of Security Pacific National Bank and vice president of administration and finance of Hungry Tiger, Inc. He served as the chairman of the Los Angeles Region of the California Bankers Society and is a member of the boards of the Los Angeles Philharmonic Association and the San Gabriel Council of the Boy Scouts of America. Cheney is a distinguished alumnus of the Harvard School of Business, UCLA's Graduate School of Management, and Claremont McKenna College.

A partner in the law firm of O'Melveny & Myers, Joseph Ryan heads the Corporate Practice and Capital Markets Group of the firm's downtown Corporations Department. He obtained his legal education at Columbia Law School and is an alumnus of the University of Washington, where he was a member of the school's 1964 Rose Bowl team. He serves

on the Board of Directors of the Pasadena Playhouse, the Westridge School, and the Planetary Society.

The president and chief operating officer of Walt Disney Company, Frank G. Wells was formerly vice chairman of Warner Bros. Inc. and a partner in the entertainment law firm of Gang, Tyre and Brown. He graduated Phi Beta Kappa from Pomona College, attended Oxford University as a Rhodes Scholar, and earned his LLB degree from Stanford University. He serves on the Board of Trustees of Pomona College and the Board of Overseers of the RAND/UCLA Center for the Study of Soviet International Behavior. A member of the Explorers Club, Wells set out to climb the highest mountains on each of the world's seven continents within a single year, a feat never before accomplished. He scaled six of the summits and, with Dick Bass and Rick Ridgeway, developed the story of their adventures for the book *Seven Summits*.

A partner in the accounting firm of Deloitte Haskins & Sells, Sheldon Richman is a certified public accountant and attorney who has been a member of the museum's Alliance Board since 1986; as member of this board, he has served on the Finance and Personnel & Compensation committees. Richman is a member of the Board of Trustees of the Hacienda La Puente Unified School District, president of the Puente Hills Community Programming Corporations, and is active in numerous other community organizations.

ARCO Foundation and Northern Trust Fund Museum's Free Day Program. The ARCO Foundation and Northern Trust of California have provided a seed grant to fund the museum's free day program through 1988. By covering a portion of the annual cost of admission fees for all visitors on the first Tuesday of every month and children ages 5 to 17 on all other Tuesdays, these gifts make the museum's cultural resources accessible to a wide range of people for whom even the museum's regular low fees represent hardship—especially low-income families and senior citizens.

The generosity of ARCO and Northern Trust is particularly significant as the museum strives to reach underserved constituencies during its seventy-fifth-anniversary year. The museum hopes to encourage first-time museum goers to become repeat visitors by introducing them to special seventy-fifth-anniversary events and exhibits through the free day program.

The museum's public programs give visitors a knowledge of the world's his-

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TERRA

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AND THE PAGE MUSEUM
OF LA BREA DISCOVERIES
TERRA, VOL. 26, NO. 6 • JULY/AUGUST 1988

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COVER: Marble statue of Tyche (city goddess) of Caesarea, carved in the first half of the second century A.D. The goddess is depicted as an Amazon, a warrior woman. The small male figure to the lower right personified Caesarea's harbor Sebastos. Collection of the Israel Department of Antiquities and Museums. Photograph by Richard Strauss.

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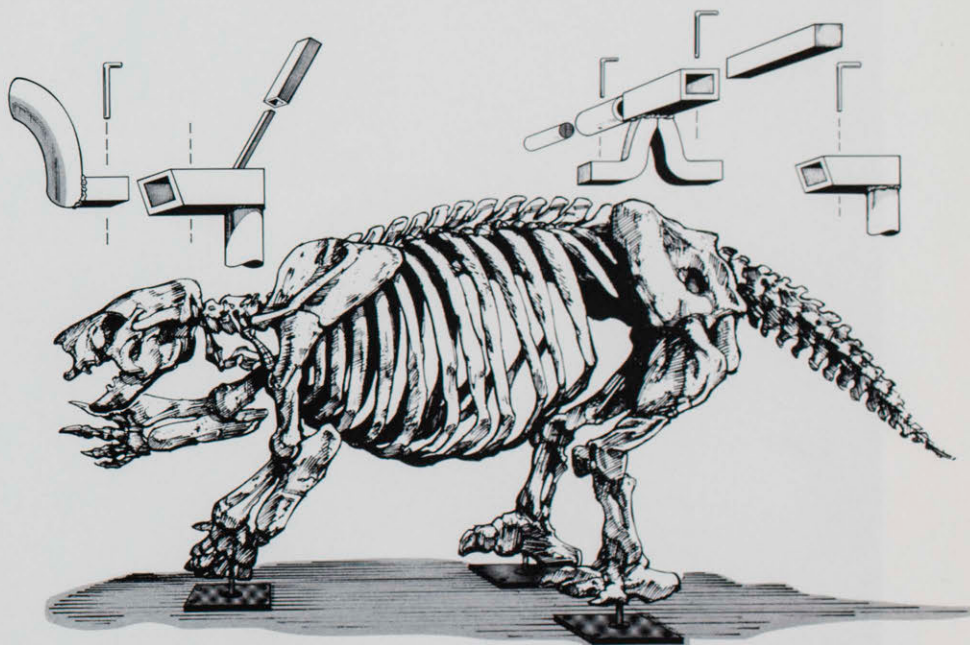
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Telephone: 805 / 496-3500
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TERRA is published bimonthly by the Natural History Museum of Los Angeles County and is sent as a benefit to museum members. Single copy price: \$2.50. Subscriptions: \$12 per year. For membership information, visit the Membership Office at the Natural History Museum or call 213/744-3426. All other inquiries can be referred to the Publications Office, Natural History Museum, 900 Exposition Boulevard, Los Angeles, CA 90007. Printed by North Hollywood Printing Co., Inc. Color separations by Toppan Graphic Arts Center West. Typography by RS Typographics. All Rights Reserved. Reproduction in whole or in part without permission is prohibited. ISSN 0040-3733

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As part of its seventy-fifth anniversary celebration, the museum has assembled a traveling exhibition, *Treasures of the Tar Pits*, from its Rancho La Brea collections. The drawing shows a Harlan's ground sloth that has been remounted for the exhibition. The articles beginning on page 11 tell how it was done.

EXCAVATING KING HEROD'S CITY: CAESAREA ON THE SEA

by KENNETH G. HOLUM and ROBERT L. HOHLFELDER

Every archaeological site has a personality of its own. The experts have written good textbooks systematizing the methods of archaeology, but even so each excavator must tailor his or her strategy to suit a unique situation. A prehistoric site in the United States yielding flints, seeds, and the imprint of baskets on compacted soil layers will be treated differently from Pompeii, where excavating consists of removing tons of loose volcanic ash, or *lapilli*, from ancient buildings that are, except for their roof structures and other wooden elements, essentially intact.

Similarly, each archaeological site has a different story to tell. Pompeii presents to the visitor the image of an entire living city frozen in time by a volcanic eruption one August day in A.D. 79. Emerging from the jungle in splendid isolation, the temples of Chichén Itzá in the Yucatan evoke the ghostly rituals of a priesthood imposing its rule over frightened peasants. Skeletons from a seventh-century

necropolis in Israel's Negev Desert reveal the diseases of those who lived in the nearby town, at what age they died, and the intermixing in the population of desert nomads with immigrants from Europe. Indeed, the human stories that archaeologists bring to light with their trowels are as textured and multifaceted as the entire human past.

Caesarea Maritima in Israel—subject of the exhibition **King Herod's Dream**, which opens for a three-month engagement at the Natural History Museum on July 16—is a site of unusual fascination. The special strategy that this site requires is simultaneous underwater and terrestrial exploration because much of its spectacular ancient harbor now lies submerged beneath the blue Mediterranean. Hence the exhibit features the work of two complementary archaeological teams: the Joint Expedition to Caesarea Maritima (JECM, a consortium of a total of twenty-two higher educational institutions in the United States

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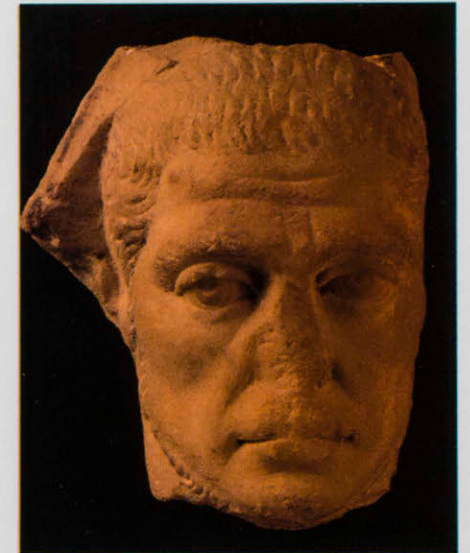
Page 5, top: Image of the season Spring from a mosaic pavement of the Byzantine period (sixth century A.D.) excavated by JECM. Spring is depicted as a winged woman holding a basket of roses. The classical style and skilled workmanship obvious in this major work of art display the exquisite taste of wealthy patrons in Byzantine Caesarea. Israel Department of Antiquities and Museums collection. Photograph by Aaron Levin.

Below: The site of ancient Caesarea, aerial view looking east. Ruins of the northern and southern breakwaters of King Herod's harbor Sebastos are visible in the foreground. Beyond, on the shore, Crusader fortifications from the thirteenth century enclose the center of ancient Caesarea. In the Byzantine period (A.D. 325–640) the city expanded to include the entire area visible in this photograph, most of it still unexcavated. Photo courtesy of the Pictorial Archive (Near Eastern History), Est.



KING HEROD'S DREAM: CAESAREA ON THE SEA opens July 16 and runs through October 9, 1988, in the museum's Governor's Gallery. Members receive two free reservations; additional reservations are available at the museum's south entrance or from TicketMaster outlets at the May Company, Sportmart, and Music Plus or through TicketMaster by phoning 213/480-2000, 619/232-0800, or 805/583-8700. TicketMaster charges a service charge of \$1 per reservation plus \$1 per reservation order; those purchased at the museum carry no service charge. Adult reservations are \$5 each; full-time students with I.D. and seniors are \$3 each; children (5–12) are \$1 each; and children under 5 are admitted free. The exhibition is open Tuesday through Sunday, 10 a.m. to 5 p.m.

The Los Angeles run of **King Herod's Dream** is cosponsored by the Hebrew Union College Skirball Museum and the Milken Family Foundation. Additional support was also received from Newton Becker. The exhibition was organized by the Smithsonian Institution Traveling Exhibition Service, the University of Maryland Center for Archaeology, the Caesarea Ancient Harbour Excavation Project, and the Joint Expedition to Caesarea Maritima in cooperation with the Department of Antiquities and Museums, State of Israel.

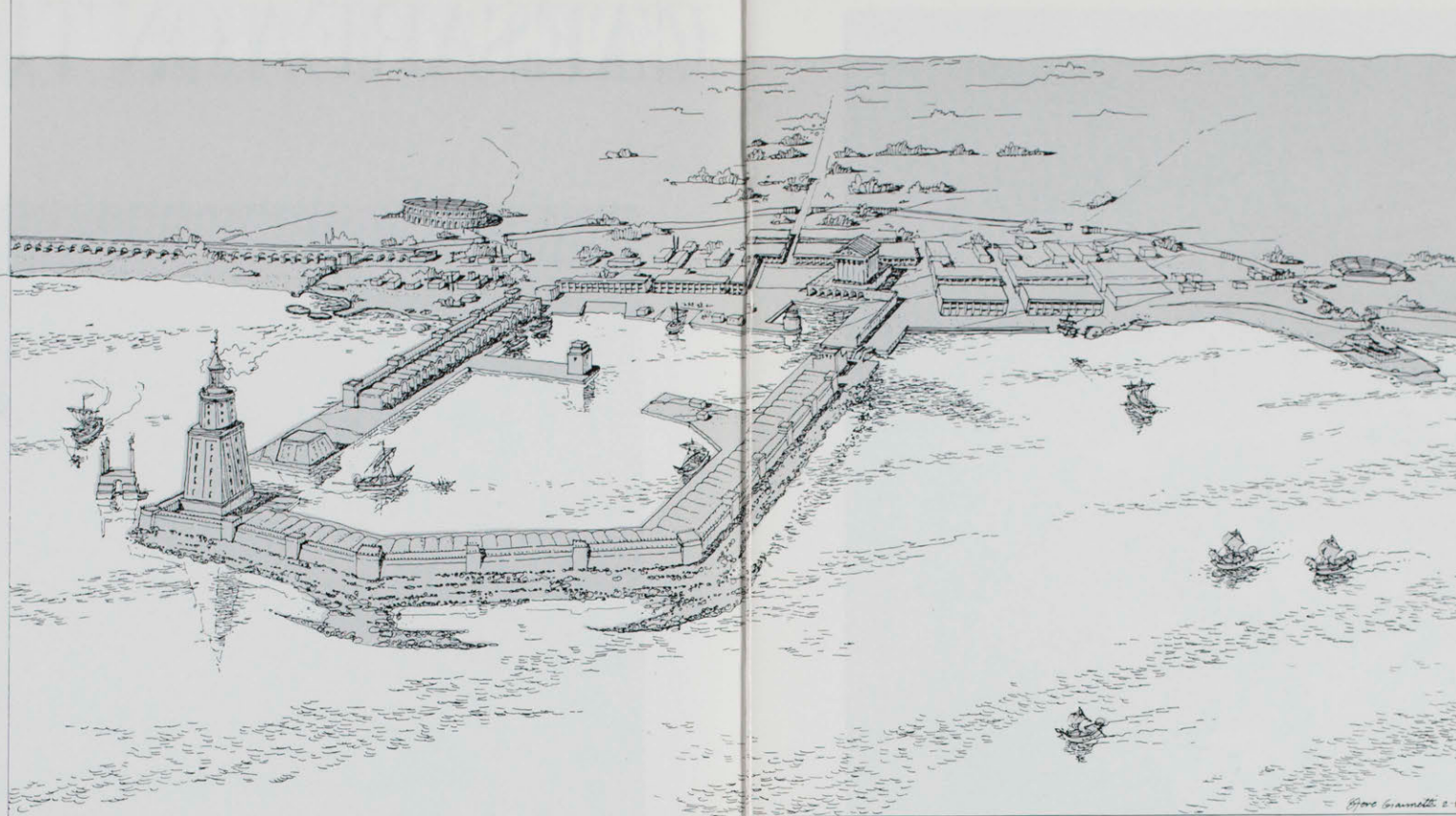


Male portrait from a marble relief of the Roman period, probably the third century A.D. Collection of the Museum of Ancient Art, Haifa. Photograph by Aaron Levin.



Caesarea's Crusader fortifications, looking westward toward the sea. The design of these fortifications, as they were remodeled in the thirteenth century, reflects European ideas in defensive architecture. Photograph by Aaron Levin.

Perspective view of Herod's Caesarea about 10 B.C., looking eastward. In the foreground, the southern breakwater of the harbor Sebastos, explored by the Caesarea Ancient Harbour Excavation Project (CAHEP), curves to the northwest. A lighthouse and the seaward end of the northern breakwater flank the harbor entrance. Herod's temple to Rome and Augustus dominates the harbor from a platform of vaults. The aqueduct approaches from the north, and outside the city walls lie the amphitheater (left) and the theater (extreme right). Drawing by Steve Giannetti.



Engraving of Caesarea designed by W. H. Bartlett, who visited the site in 1842, and engraved by C. Cousen. This view looks southward from the shore toward the ruins of the Crusader citadel (left) built atop the remains of King Herod's southern breakwater. The columns in the sea came originally from Caesarea's colonnaded streets but were reused in the twelfth and thirteenth centuries to form a jetty protecting the small Crusader harbor. DIAR collection, photograph by Aaron Levin.

Continued from page 4

and Canada) explores Caesarea on land, while the Caesarea Ancient Harbour Excavation Project (CAHEP, sponsored by the Center for Maritime Studies in Haifa) has devoted itself to underwater work, especially the remains of the port.

Caesarea also has a distinct personality. It is not one of those rare classical sites where one can actually enter the living rooms of the ancients and experience the flavor of everyday life. In compensation Caesarea offers a synopsis of an ancient city's life cycle. City life survived at Caesarea for an unusually long period—nearly 1,700 years. Here the archaeologist and the visitor learn what historical forces brought a city into being, how that city contributed to civilization, why it prospered, and how it survived the most wrenching religious and environmental changes possible until its destruction in war.

Along a sandy shore about fifty kilometers (thirty miles) north of Tel Aviv, a small rocky headland and the mouth of a stream behind it once offered haven to prehistoric mariners threatened by stormy seas. In the fourth century B.C. the Phoenicians, intrepid seafarers and traders from cities further north, established the first permanent settlement, probably to give them access to the agricultural products of the rich coastal plain. They named the town Strato's Tower, drawing attention to the lighthouse or fortified watchtower that was apparently its most prominent

building and honoring the king who had taken the lead in settling it. King Strato, of the Phoenician city Sidon, was the first in a long line of ancient urban developers who helped make this place a bustling city.

Strato's Tower prospered in the second century B.C., to judge from the large quantities of pottery of that period that the archaeologists have found at Caesarea. CAHEP has also located the two small harbors of Strato's Tower. These were of the usual Phoenician type, enclosed basins carved out along the shoreline and protected on the seaward side by jetties fashioned from large blocks of cut stone. By about 125 B.C. Strato's Tower was even a fortified city, according to CAHEP, defended by masonry battlements fitted with round

HEROD ORDERED HIS ARCHITECTS TO DESIGN SPLENDID BUILDINGS THAT EXPLOITED A STUNNING NATURAL SETTING TO CONVEY AN IMPRESSION OF HIS TASTE FOR THE GRANDIOSE AND THE MAGNIFICENT.

and polygonal towers. In the first century B.C., however, when the Jewish kings of the Hasmonaean family had incorporated the site into their domain, Strato's Tower declined and apparently fell to ruin.

This set the stage for Herod the Great, king of Judea from 40 to 4 B.C. and one of history's fascinating characters. Many of Herod's Jewish subjects hated him, much preferring his Hasmonaean predecessors, and he could rule only because he had convinced the all-powerful Romans to back him. Herod was also a prolific and creative builder who used construction projects for political purposes. He rebuilt the Second Jewish Temple in Jerusalem, for example, hoping by the scale and magnificence of his work to persuade the Jews to accept his dominion. The famous palace-fortresses of Masada and Herodion helped him control the countryside and would serve as places of refuge if his enemies won the upper hand.

Each of his great buildings also reveals another side of Herod's character. More than a politician and statesman, this king was an imaginative and daring aesthete. He enjoyed buildings that were lavishly decorated in marble and gold leaf or with architectural sculpture, wall frescoes, and floor mosaics, all in a classical Graeco-Roman style. Herod ordered his architects to design splendid settings, including Roman-type baths, porticoes, and dining rooms, in which he could entertain his friends and distin-

guished visitors. He wanted buildings that in one way or another exploited a stunning natural setting, or even improved upon nature, to convey an impression of his taste for the grandiose and magnificent.

At Caesarea—the archaeologists have found—Herod acted as both politician and aesthete. On the mostly deserted site of Strato's Tower he built an entire city between 22 and 10 B.C. Like other ancient kings (Alexander the Great, for example) he planned to win fame and popularity as a champion of urbanism. If he built the Temple in Jerusalem for Jews, now he constructed an entire new city specifically for the non-Jews in his kingdom, fitting it out with pagan temples and with a theater for dramatic performances and an amphitheater for the combats of gladiators—entertainments popular among Greeks and Romans. Above all, Herod expected this project to cement his relations with the Romans. He named the city for his principal Roman patron, the emperor Caesar Augustus, dedicating the city's main temple to Augustus the god and to Rome.

The harbor was something special. Apparently Herod saw a need for a new port on a coast that would offer ship captains a rare opportunity to seek shelter from storms and dangerous currents. There were also political and financial advantages in creating a facility that would more easily bring the agricultural production of his kingdom's rich coastal plain onto the world's markets and that

might even capture some of the business of the great port of Alexandria in Egypt. Thus Herod ordered his architects and engineers to construct the grand north and south breakwaters that enclosed the main harbor basin as well as ranks of vaulted warehouses—some of which JECM has explored—to contain the goods passing in and out of Caesarea. Herod named the port Sebastos, which is the Greek translation of Augustus.

As an aesthete Herod chose the latest word in Graeco-Roman urban design for his new city, laying it out on a grid plan with streets parallel to each other or crossing at right angles and an agora (marketplace) at the city center. To keep excited and unruly crowds off the city streets, he arrayed the theater and amphitheater outside of the city's walls. For

THE HARBOR WAS SOMETHING SPECIAL. HEROD BUILT A NEW PORT—ON A STORMY COAST SINGULARLY UNSUITED FOR BREAKWATERS—THAT HE HOPED WOULD RIVAL THE GREAT PORT OF ALEXANDRIA IN EGYPT.

the majestic temple of Rome and Augustus he created a platform above a series of warehouse vaults on which this columned classical building would crown both the city and the harbor.

The latter was clearly Herod's pride. Powerful currents and battering storms made this coast singularly unsuited for the construction of breakwaters jutting into the sea, but, as the Jewish historian Josephus put it about a century later, "Herod conquered nature herself." Since unstable sand beaches and heavy seas made it impossible to move stone blocks large enough to build the breakwaters, the king adopted a new technology developed earlier in Italy and imported for this purpose into his kingdom: hydraulic concrete. Herod's workmen lowered baskets of special liquid mortar into wooden forms constructed on or near shore and floated into position in the sea. Thus Herod's workmen created gigantic blocks of artificial stone that resisted the most powerful natural forces. Beyond the harbor's practical, economic side, it appealed to Herod's aesthetic sense because it gave him a chance to prove himself superior to one of nature's most powerful forces, the relentless and unruly sea.

King Herod built Caesarea not only to win the approval of Augustus, for whom the city was named, but as a monument to his own creative genius. It is indeed fitting to think of Caesarea as "King Herod's dream" and to look to continuing excavations for further insight into

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Ceramic bowl from the Islamic period (ninth century A.D.), found at Caesarea by JECM. Decorated with multi-colored glaze, this vessel features a partridge or other game bird walking in a field of plants and flowers. DIAR collection. Photograph by Aaron Levin.

Marble column capital of the Corinthian order, one of many to be seen at the site that may come from the city's colonnaded streets. Photograph by Paul Saivetz, courtesy of the Joint Expedition to Caesarea Maritima (JECM).

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what was on Herod's mind.

Surely King Herod wanted his city to prosper into the future so that his genius would not be forgotten—a dream that was definitely fulfilled. The Romans, powerful friends of the Jewish king, saw to it. In A.D. 6, ten years after Herod's death, they made Caesarea the capital of Judea, now a province of the Roman Empire (later renamed Palestine). One of the Roman governors stationed at Caesarea was Christ's executioner, Pontius Pilate—a point brought home in 1962, when Italian archaeologists found a stone in the city's theater with a text inscribed on it recording that Pilate had dedicated a temple at Caesarea to the emperor Tiberius. During the Jews' unsuccessful war for independence, fought between A.D. 66 and 70, the Roman commanders made Caesarea their base of operations; after defeating the Jews the emperor named the city a Roman colony, meaning that it ranked among the premier, and most loyal, cities of the empire.

The archaeologists have found that the people of Caesarea embraced Roman ways enthusiastically and made their city a hotbed of Romanism, from which the culture of Rome and the western Mediterranean radiated into the land of the Jews. To judge from sherds of oil lamps, bowls, and plates found in excavations, many Caesareans preferred tableware and objects of everyday life imported from Italy to items of local manufacture. Fragments of amphoras (shipping jars) show that they likewise imported wine and the popular condiment called *garum*—"a stinking sauce of putrid fish," one source calls it—from Italy and the west. Many of the merchant ships that brought these goods, like one vessel found shipwrecked in the bay north of Caesarea, had home ports in the western Mediterranean. Furthermore, inscriptions in Latin, like the Pilate stone, indicate a Latin-speaking population. The gods and goddesses worshiped at Caesarea included such Greek deities as Athena, Artemis, and Dionysus, which were also popular at Rome, as well as the Roman gods Jupiter and Mithras. In fact, JECM excavated the ruins of a Mithraeum, a cult center of Mithras, that was installed about A.D. 100 in one of the warehouse vaults from Herod's time. The only Mithraeum found thus far in Israel, this building represents a cult of the Unconquered Sun that was much more common in Italy and among the Roman troops along the northern frontiers of the Empire than in the Greek east.

The Roman emperors recognized Caesarea's role in transmitting Roman culture and rewarded her for it. Emperor Hadrian, who reigned from A.D. 117 to 138, ordered Roman troops stationed at Caesarea to build a new aqueduct channel to double the capacity of the one

Herod had provided when he founded Caesarea. The new aqueduct was a triumph of engineering, bringing free-flowing fresh water from springs in the foothills of Mount Carmel fifteen kilometers (about nine miles) to the northeast, part of the way in a tunnel carved through solid rock. Hadrian may also have been the imperial benefactor who built Caesarea's hippodrome or circus, a facility designed for the ultra-Roman spectator sport of racing chariots. Another Roman emperor, perhaps Septimius Severus (reigned A.D. 193–211), apparently financed construction of Caesarea's street colonnades. Such colonnades lined paved streets in many distinguished Roman cities, providing shaded walkways in front of the shops that opened onto the major thoroughfares. Today visitors to Caesarea find numerous graceful column and column capitals from the street colonnades scattered across the site.

Then, during the fourth century,

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Herod's city became Christian. Edward Gibbon, the brilliant eighteenth-century English author of *The Decline and Fall of the Roman Empire*, argued that the new religion hastened the collapse of the empire by diverting ancient men and women to such otherworldly pursuits as monasticism. Gibbon did not know about Caesarea, however, a city that flourished as never before during the Christian or "Byzantine" period (A.D. 325–640). Like other ancient cities excavated in recent decades, Caesarea demonstrates the weakness of Gibbon's hypothesis.

Long before, Caesarea had already made an outstanding contribution to the Christian movement. This was the city where Saint Peter had converted the Roman centurion Cornelius and his household to the new faith within a few years after Christ's crucifixion (Acts of the Apostles 10). This conversion was a momentous event in the history of Christianity, because for the first time Gentiles—men and women who were not Jews—became full members of the fledgling Christian church.

For several centuries Caesarea's Christian community grew slowly and in almost total obscurity. Then, in 303, when it numbered in the thousands, it was struck by a savage persecution unleashed by the Roman emperor Diocletian. Many died gruesome deaths by torture in the prisons or as victims of wild beasts in Caesarea's amphitheater. Eusebius, bishop of Caesarea and a famous historian of the Christian church, praised the martyrs' faith and courage in his book *On the Martyrs of Palestine* first published in 311.

In 313 a new emperor, Constantine the Great, ended persecution and adopted Christianity himself, making it the empire's official religion. The inhabitants of cities across the Mediterranean world gradually adopted the new faith. At Caesarea, a Christian church named for Saint Procopius, one of the Diocletianic martyrs, replaced the temple to Rome and Augustus upon the platform overlooking the harbor, and other churches went up in different quarters of the city.

Moreover, Palestine, of which Caesarea was still the capital, had become the Holy Land of the Christian majority. Emperors sent money to build churches and monasteries, and thousands of the faithful journeyed on pilgrimages to view the holy places connected with Christ's life and death and with the apostles and martyrs. Many came to Caesarea. It had its own holy places, like the house of Saint Cornelius and the church of Saint Procopius, but it was also the gateway to the Holy Land for many travelers who arrived either by land or by sea. Hence the city prospered and grew. The archaeologists have discovered that new walls from the Byzantine (Christian) period enclosed much more urban space than the walls that Herod built. Wherever the archaeologists dig within the walls, they discover ruins of Byzantine buildings. Their trenches always yield sherds of Byzantine pots in far greater quantities than those of any other period. Another indication of expanding population and prosperity is the construction of a new low-level aqueduct that vastly increased the city's water supply. Based on this archaeological evidence, the experts estimate that in the Byzantine period Caesarea's population reached its maximum of 100,000.

This Byzantine prosperity came despite an environmental change that might have threatened Caesarea's very existence. Recent examinations of the earth's crust have revealed a geological fault line paralleling the coast of Israel in this vicinity fifty to one hundred meters offshore. The coast is relatively stable east of this fault line, but to the west of it the sea floor tilted slowly downward in antiquity so that the north and south breakwaters of the harbor Sebastos grad-

ually slipped beneath the waves. Apparently this process had progressed so far by the year 500 that ships attempting to enter Caesarea's harbor often struck the submerged breakwaters and sank within sight of the anxious population awaiting the arrival of cargoes on shore. Again, a powerful champion of urbanism came to Caesarea's assistance. The emperor Anastasius (reigned 491–518) ordered workmen to lay new courses of stone atop the submerged breakwaters to make them functional again. Ships frequented Sebastos once more, bringing tourists from abroad and trade goods that helped make Caesarea a wealthy and comfortable city. CAHEP archaeologists believe that they have already discovered some evidence for the Anastasian rebuilding of Sebastos. As excavations continue, a major objective will be clarifying the harbor's later history.

Caesarea's fortunes changed permanently in the seventh century as the armies of Islam, set afire by the prophecy of Muhammad, swept out of the desert and conquered the Middle East. After a seven-year siege, Caesarea fell in 640 or 641. In subsequent centuries King Herod's city declined dramatically in size and population. JECM has found some archaeological evidence for willful destruction and conflagration at the time of the conquest, but since Muslim armies did not generally destroy cities or slaughter civilians it is likely that depopulation was the result of Christians abandoning Caesarea. They chose to emigrate, preferring not to live under the aegis of another religion.

Yet Caesarea—called Qaisariyah in Arabic—still survived for centuries as a smaller but still prosperous market town, the center of a fertile agricultural region. Ancient trade routes joining cities on various Mediterranean shores had broken down, but ships in the coastal trade still called at Caesarea, trading in olive oil, grain, and manufactured products. Eventually, certainly by the tenth century, new fortification walls defended the city, but they enclosed an urban area far smaller than the Herodian or Byzantine walls. Outside of these walls to the east, JECM has discovered a large industrial suburb from Muslim times devoted to manufacturing ceramic lamps and tableware, especially the beautiful bowls decorated in colorful glaze that the Muslims favored. Within the city the broad, colonnaded streets and the forum or agora (marketplace) of classical Caesarea gave way to the narrow lanes and *suqs* (market streets) of the Muslim city. On the platform of vaults overlooking the harbor, where King Herod had built his temple to Rome and Augustus, the Muslims rededicated the cathedral of Byzantine Caesarea as their great mosque. Despite dramatic changes, Herod's fundamental concept for the re-

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ligious center of his city remained intact.

In 1099 armies of European crusaders, bent on freeing the holy places of Christianity from Muslim domination, arrived in Palestine. Within two years a crusader force had besieged Caesarea, stormed it, and slaughtered or enslaved a large part of the Muslim population. The great mosque on the Herodian temple platform was reconsecrated once again as the Cathedral of Saint Peter—the apostle who had brought Christianity to Caesarea by converting Cornelius a thousand years earlier. A European feudal lord ruled Caesarea and the surrounding territory, and fought with his knights alongside his own lord, the crusader king of Jerusalem. Just after 1250, Saint Louis (Louis IX), the crusading king of France, labored in person on new fortification walls for Caesarea as a demonstration of Christian piety. These crusader fortifications, which still dominate the site, are of a design common in thirteenth-century Europe. The eastern gatehouse, excavated by Israeli archaeol-

ogists in the 1960s and beautifully restored, exhibits Gothic vaults with tracing, again a European architectural form. In its last incarnation Caesarea, its ruler, and its people resembled a European principality transplanted into the Holy Land.

In 1265 a Muslim sultan from Egypt besieged and stormed crusader Caesarea, and—in striking contrast with the European invaders of 1101—permitted the surviving defenders to depart unharmed. In 1291 the Mamluk sultan Baybars ordered Caesarea's fortifications leveled to prevent the Europeans from using them to establish a new foothold in Muslim territory. The long history of King Herod's city had come to an end. Sand dunes advanced across the city and the surrounding fields, choking the streams and creating malaria-infested swamps. From time to time a tiny village eked out an existence amid the ruins, and occasionally visitors from Europe or elsewhere in the Middle East stopped for a brief look, attracted by the imposing ruins that still witnessed Caesarea's ancient fame.

An ephemeral community of Muslim refugees from the Austro-Hungarian Empire settled in the Crusader fortifications in 1882, and in 1940 Jewish pioneers established Kibbutz Sdot Yam ("Fields of the Sea") just to the south of ancient Caesarea. The site itself has remained unoccupied, except for a few shops and restaurants that cater to increasing crowds of tourists.

When archaeologists began systematic excavation of Caesarea in the 1950s and 1960s, they had an open field for their work, generally unobstructed by modern development. After nearly forty years, teams from Israel, Italy, and later JECM and CAHEP, have laid bare only a tiny portion of ancient Caesarea's monuments. This site remains one of the most promising laboratories available anywhere for studying the development of cities over time, an engaging and vital area of research for all who share in the life of modern cities. Thus the archaeologists of CAHEP and JECM expect to continue in the future, excavating the ruins of King Herod's city.



Scale model of a Roman merchant ship from the first century A.D. under construction at the Smithsonian Institution's Office of Exhibits Central for use in the exhibition *King Herod's Dream*. This model is based in part on a shipwreck that CAHEP is investigating in shallow water just north of the city. Aaron Levin photo.

*The authors of this article worked together as principal curators of the exhibition **King Herod's Dream**, which was produced by the Smithsonian Institution Traveling Exhibition Service in cooperation with the University of Maryland Center for Archaeology and the Israel Department of Antiquities and Museums. We acknowledge with thanks the collaboration of Robert J. Bull, director of the Joint Expedition to Caesarea Maritima, Avner Raban, director of the Caesarea Ancient Harbour Excavation Project, and R. Lindley Vann, curator of architecture for the exhibit.*

TREASURES OF THE TAR PITS

Mount Up! The Skeletons of Rancho La Brea on Display

by ERIC SCOTT

A

s part of its seventy-fifth anniversary celebration, the Natural

History Museum has assembled a traveling exhibition, **Treasures of the Tar Pits**, from its Rancho La Brea collections for a nationwide tour. This exhibition consists of mounted skeletons, individual bones, and other fossil and geological materials recovered from the Rancho La Brea asphalt seeps in Los Angeles, the richest deposits of terrestrial Ice Age fossils in the world. Destined to spend the next several years on tour, this seventy-fifth anniversary road show can be seen at the Natural History Museum from August 16 through September 18 before starting out on its historic trek in October.

TERRA presents two articles that explain how these long-dead animals are brought to life by museum technicians. Eric Scott describes the history of the mounted skeletons of both extinct and still-existing forms found at Rancho La Brea, their reconstruction, and reconstructors. Christopher A. Shaw explains how they did it and how reconstruction techniques have changed over time to produce exciting displays that are both naturalistic and dynamic. In addition, we present a behind-the-scenes look at the creation of a mural by celebrated nature artist Mark Hallett that shows the most up-to-the-minute ideas of how the animals and plants of Rancho La Brea looked forty thousand years ago.

Mounted skeletons of extinct animals from Rancho La Brea are vital elements in the museum's seventy-fifth anniversary traveling exhibition, **Treasures of the Tar Pits**. Remounted over the past year using state-of-the-art techniques, many of these skeletons were originally on display for several years at the Natural History Museum, some of them from early in this century. As such, they are more than just a part of the **Treasures of the Tar Pits** exhibition; they are important parts of the museum's seventy-five-year history and are veritable treasures in their own right.

The Early Years. In 1913, visitors to the newly opened Los Angeles Museum of History, Science and Art (part of what is now the Natural History Museum facility) found three vast exhibit wings awaiting them, each packed with brand-new displays. The Science wing stood filled to brimming with dark fossil bones, mounted as skeletons or locked away in gleaming glass cases—tar-saturated bones, varying in color from coffeebrown to black.

These bones, recovered from the Rancho La Brea asphalt deposits, represented only a small fraction of the entire assemblage of Ice Age fossils unearthed in the famous "tar pits." By 1915, museum storage areas were crammed full of the more than 750,000 fossil specimens found in Hancock Park, the site of the asphalt seeps, and the mounted skeletons of the extinct Pleistocene fauna were becoming the focus of attention for scientists and enthusiasts the world over.

The first skeletons of Rancho La Brea fauna mounted for the museum were designed and assembled by Eugene J. Fischer, a preparator and taxidermist at the museum from 1910 to 1946. Fischer came to California in 1907 and in 1908 collected at Rancho La Brea for the University of California. In 1910 he was hired by the museum to prepare skeletons of extinct Pleistocene animals excavated from the Hancock Park deposits.

Fischer was a prolific worker. In one year alone (1910 to 1911) he constructed skeletons of two saber-toothed cats (one for Los Angeles High School, the other for the museum), a female bison, a dire wolf, and a Harlan's ground sloth. By the

time the new museum opened, he had completed a second bison and a mastodon; by 1915, these had been joined by a titanic mount of the imperial mammoth.

The Science wing of the museum grew more crowded as the years passed, with Fischer's Rancho La Brea mounts and several mounted skeletons of modern African mammals packed into the center of the hall, a brown-and-white island surrounded by a sea of glass display cases. Fischer continued to add new Rancho La Brea skeletons to the hall—by 1920 two horses, a second camel, a new dire wolf, another saber-toothed cat, and a North American lion had joined the assemblage. A second Harlan's ground sloth, posed on all fours, was assembled in 1920 by Museum Preparator J. W. Lytle; in 1922, Lytle added a cast skeleton of the giant teratorn, a predatory bird recovered from the asphalt deposits, to the exhibit hall.

Two forms of ground sloth from Rancho La Brea were mounted: the large Harlan's ground sloth and the smaller Shasta ground sloth. The latter animal is poorly represented at Rancho La Brea, and there were no complete skeletons of the animal known from any other fossil localities in the 1920s. Assembling an entire mount therefore seemed impossible. Not to be deterred, Fischer made casts of what few bones were available, sculpted the rest in plaster according to how he deduced the missing elements should look, and then assembled the mount. It is indeed a tribute to his skill that, when complete skeletons of the sloth were eventually recovered, their bones closely resembled those in Fischer's mount.

The Rancho La Brea skeletons maintained their frozen positions into 1925, when the museum expanded and the old Science wing became Hancock Hall. The modern African skeletons were removed, leaving the Rancho La Brea fossils the sole heirs to the hall; the entrance to the exhibit moved from the north end of the hall to the south, but the skeletons stood their ground and resolutely faced the rotunda to the north. (Visitors to the museum over the next several decades were therefore welcomed by the fossilized derrières of the extinct Rancho La Brea fauna.)

In 1933, Henry A. Wylde, former Chief of Exhibits for the museum and one-time excavator at Rancho La Brea, prepared and mounted the fossil bones of a juvenile mastodon for display in Hancock Hall. Unlike Fischer's composite skeletons, Wylde's mount was a single individual animal. Unfortunately, the young animal had died before the ends of its long bones (called *epiphyses*) had fully fused onto the bone shafts; these epiphyses, as well as the animal's ribs, had not been recovered when the rest of the skeleton was excavated. Wylde had to reconstruct these missing parts in plaster to complete the mount.

Other additions to Hancock Hall included skeletons of numerous birds found at Rancho La Brea. These mounts, assembled in the early 1940s by Fischer, represent one of the crowning achievements of his professional career. Bird bones are among the most fragile of fossils, and great care is demanded when one handles the hollow, delicate specimens. His mounts were sturdy enough to support the slender bones, yet so graceful and unobtrusive that they did not detract from the overall image. Fischer's birds stood perched on tar-blackened wood branches or crouched with wings outstretched, poised for flight; the liveliness and authenticity of the poses spoke silently of Fischer's mastery of the art of skeleton reconstruction.

Modular Mounts—A New Idea. In 1946, Fischer mounted one final dire wolf skeleton for Hancock Hall, after which he retired. His skeletal mounts remained virtually unaltered until the late 1960s, when the Natural History Museum renovated Hancock Hall. The carnivore skeletons were removed from their glass cases, the wood-and-serpentine platforms were replaced with gravel, and a single broad walkway curved down the middle of the hall. Several of the mounts were isolated along the western side of the hall, relocated but otherwise unchanged. Others were either placed in storage or, in the case of the horse and camel, remounted and moved into the new Hildegard Howard Cenozoic Hall.

Museum Preparator Michael K. Ham-

mer was given the task of remounting the Rancho La Brea camel skeleton. His technique was a modification of Fischer's; Hammer used external metal posts to support his mount, but concealed the armature behind the camel's long limbs and shaped the posts to parallel the natural curvature of the legs, so that the armature could not be seen by museum visitors. The animal thus appeared to stand on its own.

Senior Preparator Leonard C. Bessom used an entirely new approach in mounting the extinct Western horse for the Cenozoic Hall. Bessom's mount appeared to stand by itself, unsupported by an exterior framework; the newly remounted horse skeleton rearing back on its mighty hind legs and pawing majestically at the sky, was a crowning achievement in aesthetics and engineering (see page 14). This vitality and grace was the result of a technique that Bessom perfected in the 1960s termed "modular mounting." (See the following article by Chris Shaw for more information on this method.)

Bessom's revolutionary technique was soon to be put to the test on a vast scale. When the Pit 91 excavation in Hancock Park was reopened in 1969, research at Rancho La Brea was once again the focus of public and professional scrutiny. Change was in the air, and a new museum was waiting to be born.

The George C. Page Museum of La Brea Discoveries. Located in Hancock Park in the Miracle Mile section of Wilshire Boulevard, the George C. Page Museum of La Brea Discoveries houses the entire vast assembly of Ice Age beasts. The skeletons recovered from the tar pits are no longer crowded together in a single hall, but are amply spaced in a museum dedicated exclusively to the history and prehistory of Rancho La Brea.

In 1975, philanthropist George C. Page donated funds for the construction of a satellite museum in Hancock Park to house the entire Rancho La Brea collection. As bulldozers moved in to excavate a foundation for the Page Museum, technicians at the Natural History Museum began disassembling the skeletons in Hancock Hall for refurbishing and transport to the new building.

Some of the skeletons were destined to remain behind at the Natural History Museum. Two of Eugene Fischer's old mounts—a coyote and an extinct North American lion—and the Harlan's ground sloth mounted by J. W. Lytle in 1920 remained along the south wall of the California Fossils Hall, in front of Charles R. Knight's famous 1925 mural depicting Hancock Park in the late Pleistocene. Two other Rancho La Brea mounts, the camel and the spectacularly rearing Western horse, remained in the Hildegard Howard Cenozoic Hall.

In 1976, Leonard Bessom came out of his

retirement at the request of George C. Page. Bessom and Pit 91 Excavator Christopher A. Shaw began reconstructing Eugene Fischer's Rancho La Brea skeletons using Bessom's innovative modular technique. In addition, the preparators decided to add a new twist to the mounting process: rather than support the skeletons from the ground, Bessom and Shaw decided to hang the mounts from the ceiling (see accompanying article).

In many cases, the new approach used by Bessom and Shaw resulted in skeletal mounts unlike any seen before. The three dire wolves in particular were the essence of what the two preparators had hoped to achieve. Suspended in mid-air one behind the other, each caught in mid-leap—the three wolves were the perfect realization of the art of skeleton mounting, with dead bone and wire mimicking an instant of life.

Bessom and Shaw also remounted one of the two massive teratorns originally constructed by Fischer. In the new mount, the great avian carnivore hung in a gliding pose above the Rancho La Brea bird exhibit, its eleven-foot wingspan fully unfurled and neck craned menacingly as it appeared to swoop down from the heights for its meal. The teratorn was the only fossil bird from the asphalt deposits to be completely remounted for the Page Museum; the remaining avian skeletons were repaired, erected upon gray plexiglass pedestals (save for a few, which were left clutching their old tar-soaked branches), and kept otherwise exactly as Fischer had mounted them almost forty years before.

Not all the skeletons in the new museum were assembled by Bessom and Shaw. The largest animal skeleton in the collection, the imperial mammoth, was begun by the two preparators but completed by the world-renowned Utah paleontologist James A. Jensen, the man later responsible for the recovery of the fossil dinosaur *Ultrasaurus*. Jensen decided not to hang the entire heavy skeleton from the ceiling, but instead built the front and hind limbs up from the floor. The torso, head, and shoulder blades were then suspended between the erect limbs, giving the impression of a unified animal skeleton. The American mastodon and Henry Wylde's juvenile mastodon were also remounted using this technique.

When the Page Museum opened its doors in 1977, it ushered in a new era. The Rancho La Brea skeletons—indeed the entire fossil collection from the tar pits, consisting of more than one million vertebrate fossils and several million fossil specimens overall—had come home to stay. Though the memory of the Ice Age beasts maintained a tenacious foothold at the Natural History Museum, it seemed that the parent museum and its first major collection had gone their separate ways. When it came time in

Treasures of the Tar Pits has been

underwritten by Occidental

Petroleum Corporation and Coldwell

Banker Residential Real Estate

Services/Southern California.

1987 to select an exhibit theme representing the museum's seventy-five-year history, however, it became apparent that nothing could be further from the truth.

Treasures of the Tar Pits. In 1987, Collections Manager Christopher A. Shaw and Museum Model-Maker Joe Cöcke began disassembling the Rancho La Brea mounts located in the California Fossils Hall of the Natural History Museum. Six skeletons—a saber-toothed cat, two dire wolves, a coyote, a North American lion, and a Harlan's ground sloth—were carted up to the Habitats Laboratory on the fourth floor of the museum for varying degrees of refurbishing and reassembly prior to setting out on the road as the centerpieces of the museum's traveling **Treasures of the Tar Pits** exhibition.

Shaw and Cöcke used Leonard Bessom's time-tested modular mounting technique for the new exhibit; virtually no external armature is visible. Lifelike poses, a hallmark of the modular approach, characterize the new mounts. In one display the giant sloth originally mounted by J. W. Lytle in 1920 appears to crouch defensively, one forepaw raised to ward off an unseen menace; elsewhere, a coyote mounted long ago by Eugene Fischer now howls mournfully at the sky.

The new exhibit is more than just skeletons, however. **Treasures of the Tar Pits** is a 3,000-square-foot educational exhibition designed to illustrate the historic, prehistoric, and paleontologic significance of the "Death Trap of the Ages." The Rancho La Brea skeletons are surrounded by individual bones, casts of important new specimens, impressive graphics panels and photographs, audio-visual presentations, and interactive displays, all illustrating the vital and continuing importance of paleontological research in Hancock Park.

Ultimately, however, it is the mounted Rancho La Brea skeletons that catch the eye and command one's attention. These skeletons, mounted and remounted over the course of the Natural History Museum's seventy-five years, are more than just the bare bones of dead animals. They are vibrant works of art and engineering, vivid reminders of past millennia; they are part and parcel of both the museum's historic past and its exciting future, bright facets in the museum's Diamond Jubilee. They are, in every sense of the word, treasures.

Eric Scott is Chief Excavator/Pit Maintenance Supervisor of the Pit 91 Excavation at Rancho La Brea. He is currently developing a sense of humor. The author thanks S. M. Cox, G. T. Jefferson, M. L. Romig, C. A. Shaw, and G. Sibley for assistance in the preparation of this manuscript.

Body by Fischer and Bessom

by CHRISTOPHER A. SHAW

Because of a unique set of geologic and geographic circumstances, cone-shaped asphalt deposits were formed between ten thousand and forty thousand years ago at Rancho La Brea that contained the bony remains of thousands of animals. The asphalt so perfectly impregnated and preserved these elements that even DNA proteins have been found within the bones. The quality and quantity of fossils from Rancho La Brea (which included many extinct forms) made them ideal raw materials to use in skeleton mounts.

Before the skeletons of any vertebrate animal can be assembled, each bone has to be located, collected, cleaned, and identified. Each component of a skeleton is carefully selected so that the correct size, shape, and proportion of the animal is maintained. This is an easier chore if the skeleton of a single individual animal is to be mounted. Each site at Rancho La Brea, however, produced so many individuals (hundreds of some species), and the bones of these animals were so mixed in the deposits, that it was necessary to construct composite mounts using the bones from several individual animals. Equally important is the selection of the materials that will support the skeleton. Again, the size, shape, and proportion of the animal, in addition to the style of the mount being prepared will determine the type and diameter of the metal mount to be used.

In 1910 Eugene J. Fischer was given the task of engineering the construction of the skeletons that were to greet the first visitors to the Los Angeles Museum of History, Science and Art. As a skilled taxidermist, Fischer had an intimate knowledge of animal anatomy and behavior and was already experienced in

designing and mounting skeletons by the time he came to this museum. Within the following four and one-half decades he built most of the thirty-two La Brea skeletons and other modern animals that were displayed together in the Science wing.

Fischer mounted the skeletons in a style that had appealed to many technicians for decades. The skeleton was supported on the outside by two or three main structures consisting of large steel pipe or heavy steel rods. These extended from a hollow base above the marble floor to the skeleton's vertebral column and were bolted at both ends. Fischer ran a square steel rod along the neural canal of the vertebrae to attach and support the head, spine, pelvis, and tail, and to maintain the curvature of the spine. In addition, he carefully drilled the body (centrum) of each vertebra and implanted a smaller brass rod to maintain continuity in the column. He hand-cut threads on both ends of this brass rod and used brass nuts to lock the bones together. Hand-pounded brass straps were attached along each side of the rib cage; these were bolted or hand-riveted to each rib and to the neck and pelvis to hold the ribs' barrel shape.

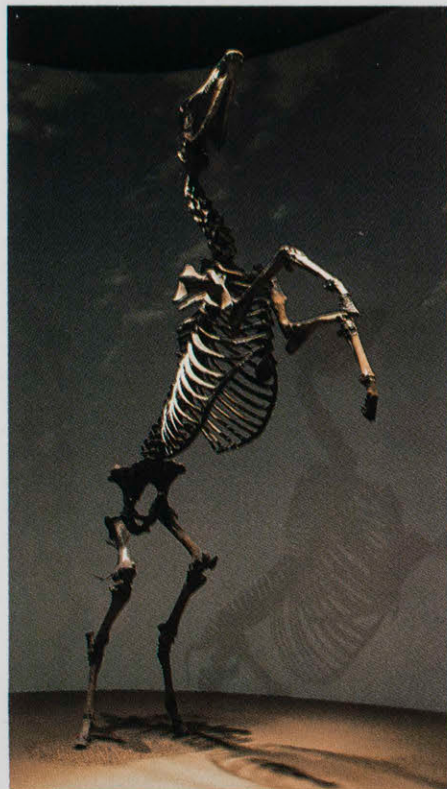
A view of the Science wing of the Los Angeles Museum of History, Science and Art taken in the late 1920s. The titanic imperial mammoth constructed by Museum Preparator Eugene J. Fischer is in the middle ground; it is proceeded in the train of animals by a reconstructed Harlan's sloth. Mounted heads of present-day North American mammals line the mezzanine. Close inspection shows the exterior framework that Fischer used to support the mammoth. Photograph courtesy Museum Archives.



The limbs on all of Fischer's mounts were never intended to bear the weight of an entire animal as in life. He drilled the limb bones of the larger animals and placed small-diameter steel rods inside merely to maintain the shape of the limb structure. Each bone rested upon the next, and they were tied together with threaded brass rods and nuts to prevent rotation around the steel rod. Fischer bolted one end of the internal steel rod into the base and the other end into the torso or pelvis of the animal. As the size of the animal decreased, so too did the size of the internal metal supports and ties or pins. In fact, in the smallest animal constructed (a coyote), there were no internal support rods except along the vertebral column. Most of this skeleton was tied together with very small-diameter brass wire.

Fischer used the latest adhesive technology available, as well as his own ingenuity, to solve some unique problems. Because he carefully tied his mounts together with brass rods, pins, or wires, adhesives were used sparingly. When small, delicate structures required repair, however, Fischer used hide glue to solve the problem. Cracks, holes, and broken pieces in larger bones were often concealed using plaster of Paris in

Continued on page 16



Museum Preparator Leonard C. Bessom used an entirely new approach in mounting the extinct Western horse for the museum's Cenozoic Hall. Bessom's mount appears to stand by itself, unsupported by an exterior framework—a crowning achievement in aesthetics and engineering. Photograph by Larry Reynolds.

The Making of a Mural

A Vivid New Look at Rancho La Brea Life 20,000 Years Ago

Below: Artist Mark Hallett studies a dire wolf skull. Hallett is seen at work on a sketch of the Rancho La Brea mural that will be traveling with the museum's seventy-fifth anniversary show, **Treasures of the Tar Pits**. Photograph by Veronica Tagland.

Page 15, left: Hallett's reconstruction of the musculature of the saber-tooth cat skull at full gape and in repose is part of the artist's meticulous groundwork for the larger mural.

Page 15, right: A color preliminary study of two adult saber-tooth cats and one juvenile feeding on a Harlan's ground sloth shows hypothetical color patterning.

Page 15, bottom: A black-and-white sketch of a portion of the mural scene shows two saber-tooth cats devouring a dead Western horse while keeping dire wolves and a hungry coyote at bay. When completed, the mural will be some 8½ feet long and 4 feet high and include accurate representations of many of the animals and plants found in the asphalt deposits at Hancock Park. Note the California Quail in the foreground; while some of the flora and fauna found in the deposits are now extinct, some, such as the quail, still live in Los Angeles County.



Continued from page 14

combination with fencing wire. The size, weight, and relatively poor preservation of the mammoth bones presented their own difficulties. Fischer solved these problems by using ample amounts of chicken wire and plaster to strengthen the bone and filling large cavities in the bone with light-weight materials; newspaper was a favorite item, but the tattered remnants of an aged felt hat were also discovered in one limb bone!

When confronted with missing bones of rare animals, Fischer often sculpted a facsimile in wood. He fashioned many wrist and ankle bones in this way for ground sloths, lions, saber-tooth cats, dire wolves, and the coyote. One of the thigh bone shafts of the short-faced bear was carved from an ax handle! Costal cartilage joins ribs to the breastbone, but this tissue rarely fossilizes. Fischer reconstructed the cartilage in the animals he constructed by bending a brass wire framework into the proper shape and applying layers of papier mâché to it until the correct diameter of the cartilage was obtained.

Construction of the George C. Page Museum ushered in a new era for Fischer's mounted skeletons. Many of the proposed exhibits were new and innovative, designed to stimulate the imagination, create a mysterious atmosphere, and introduce future generations to the legacy of the asphalt deposits. Many of the skeletons originally mounted by Fischer were completely renovated and modernized by Museum Preparator Leonard Bessom.

Bessom internalized the skeleton's main support structures as his first step in the modernizing the mounted fossils. Fischer's original mounts were completely dismantled except for the rib cage (including the papier mâché cartilage) and the vertebrae that the ribs were attached to; the metal rods, ties, and pins were discarded (including those bolted or riveted to the rib cage) except for the main support steel that he placed inside the neural canal of the vertebral column. Bessom drilled larger holes into the limb bones to accommodate the greater diameter of the steel support rod and manufactured twisted double-stranded brass wire to string smaller bones together. He intended to conceal as much of the manufactured support system as possible, thus imparting a more natural appearance and dynamic pose to the mounted animal.

Bessom's innovation did not stop here. At critical points on the skeleton he designed detachable joints—solid square pegs that slip inside square tubing and are secured by a metal pin—so that units (or "modules") could be easily removed for cleaning, repair, or research purposes. Once the skeleton was cemented to this superstructure with polyester resin, no weight was borne by the bones. Bessom experimentally found that, if thickened

with very fine sawdust, the hardened resin resembled the deep brown color of the La Brea fossils.

Once mounted, over half the completed fossil skeletons at the Page Museum were not installed attached to a base, in the traditional manner—they were suspended from the ceiling using very strong, finely braided stainless steel cable that was developed by the aerospace industry. In addition to the cable's strength and aesthetic qualities, it is thought that a suspended mount will sustain less damage in the event of an earthquake.

By remounting Fischer's original skeletons, Bessom effectively created technologic and anatomic art forms. Bessom's mounts are innovative and aesthetic; in many cases, the poses reflect a frozen moment in time. In addition, by hanging a skeleton from the ceiling and making it modular, his design is also quite functional.

In July 1987 work began to create a traveling exhibition, **Treasures of the Tar Pits**, to commemorate the seventy-fifth anniversary of the Natural History Museum. Joe Cöcke and I (both apprenticed to Bessom) were enlisted to redesign three skeletons using the modular system. Renovation began with the largest animal, a Harlan's ground sloth, which was originally constructed by J. W. Lytle in 1920. Lytle mounted this skeleton in the same style as Fischer. Once remounted (a project lasting seven months), an American lion and a coyote, both built by Fischer, were completed in an additional three months. All three animals were mounted in more dynamic poses, with the ground sloth in a defensive stance, the coyote howling, and the lion in an attentive posture. Three other skeletons (one saber-tooth cat and two dire wolves), all in menacing poses that Bessom and I constructed in 1976, will accompany these animals.

This exhibit is intended to travel to different venues in North America every three months for the next five or more years. For this reason, Bessom's modular design seems ideal. The ability to disassemble the skeletons into ten to sixteen units will facilitate crating and shipping and will decrease potential breakage en route. Before it leaves on its historic journey, there will be a preview showing of the exhibition beginning in August at the Natural History Museum.

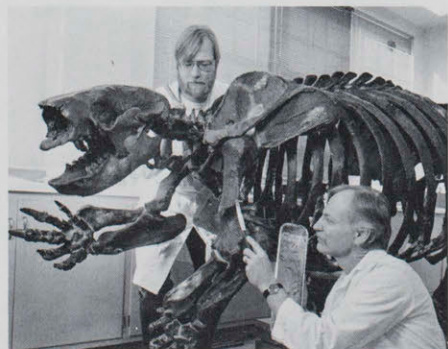
Christopher A. Shaw is the Collection Manager at the George C. Page Museum of La Brea Discoveries. He assisted Leonard Bessom with the skeleton remounting and other exhibits at the Page Museum and has been working with Rancho La Brea fossils for over fourteen years. He would like to thank M. L. Romig, E. Scott, and A. E. Tejada-Flores for critically reading earlier drafts of this article.



*Museum Preparator Eugene J. Fischer at work in the 1940s on a fossil Woodward's Eagle (*Amplibuteo woodwardi*; now extinct) from Rancho La Brea. Photograph courtesy Museum Archives.*



*Museum Preparator Leonard C. Bessom refurbishing an American Lion (*Felis atrox*) originally mounted by Eugene Fischer. Photograph courtesy of Museum Archives.*



*Page Museum Collections Manager Christopher Shaw (left) and Museum Model-Maker Joe Cöcke (right) put the final touches on their reconstructed Harlan's sloth. This skeleton was originally mounted in 1920 by Museum Preparator J. W. Lytle; it will be traveling in the museum's **Treasures of the Tar Pits** exhibition. Photograph by Dick Meier.*

SPOTS BEFORE OUR EYES

A Unique Fossil Sheds Light on the Color Pattern of a Turtle that Died 63 Million Years Ago

by ROBERT M. SULLIVAN and SPENCER G. LUCAS
Photographs by Robert M. Sullivan

In August the sun is brutal in the San Juan Basin of northwestern New Mexico. Morning temperatures rapidly soar into the high nineties, and shade is nonexistent. In the highly eroded badlands, the heat of the sun is reflected and soaked up by layers of lightly colored sandstone and mudstone that are brilliantly accented by bands of red, black, green, and gray. Although these starkly beautiful badlands may seem inhospitable to all except the occasional lizard, to the paleontologist this area contains the lifeblood of a profession, a wealth of fossils from ages long past.

Indeed, the beauty of this landscape and its phenomenal fossil record formed the primary impetus for the recent designation by Congress of a portion of the San Juan Basin's badlands as a federal wilderness. The so-designated De-na-zin Wilderness Area encompasses a portion of the upper reaches of De-na-zin Wash and adjacent arroyos that are northeast-southwest-flowing tributaries of the Chaco River. These arroyos cut through sedimentary rocks that document one of the most profound changes in the history of life on land—the transition from the terminal Cretaceous, the end of the Age of Reptiles, to the early Tertiary, the beginning of the Age of Mammals (66.4 million years ago). Rocks exposed in the western portion of the wilderness area, the older rocks, are of Cretaceous age and give us a glimpse of the world during the final heyday of the nonavian dinosaurs. Above these rocks, to the east, are Paleocene strata (rocks deposited during the Paleocene Epoch, the first epoch of the Tertiary Period, 66.4 to 57.5 million years ago) that do not contain the large, more primitive dinosaur fossils that, in part, characterize the Upper Cretaceous rocks. Instead, they contain a plethora of fossils of primitive mammals, lizards, snakes, turtles, champsosaurs (an aquatic crocodilelike reptile related to the modern *Sphenodon*) and crocodilians, which were among the first Tertiary vertebrates.

For nearly a decade we have investigated the fossil record in this area that

documents this transition from the Late Cretaceous to the Tertiary, focusing much of our attention on the earliest part of the Tertiary, the Paleocene. In August 1986 Robert Sullivan, assisted by Dennis Umshler, Barbara am Ende (both of the United States Bureau of Land Management), and Kim Martini (undergraduate student at the University of New Mexico, Albuquerque) set out to search for early Paleocene vertebrates in the De-na-zin Wilderness Area. Under a special collecting permit issued to Sullivan as part of his continuing research on the Paleocene fossil record of lower vertebrates (fossil fish, amphibians, and

IT WAS NOT UNTIL WE FLIPPED THE FOSSIL TURTLE OVER THAT THE UNIQUE COLOR PATTERN WAS REVEALED. THIS TRULY WAS AN EXCITING MOMENT: NO COLOR PATTERN OF A SHELL OF A FOSSIL TURTLE HAD EVER BEEN DISCOVERED.

reptiles), funded in part by the National Science Foundation and sponsored by the Natural History Museum of Los Angeles County, we collected fossils here and at other localities in the Paleocene strata of the San Juan Basin that geologists term the Nacimiento Formation.

We came upon a fossil turtle atop a ridge in the De-na-zin badlands about one mile from our camp, which lay outside the wilderness boundary. It was immediately evident that the turtle, partially emerging from the sediment in which it had been encased for about sixty-three million years, was nearly complete. Only the right side of the turtle was slightly eroded, and the left side was still partially buried in sediment.

Turtle specimens are very common in the Late Cretaceous and early Tertiary strata of the San Juan Basin. Most turtle specimens, however, consist of disar-

ticated pieces—broken shell fragments belong to the plastron (lower shell) or carapace (upper shell). Finding a relatively complete turtle shell is a rare event, and thus collecting such a specimen is extremely important. We were soon to discover, however, that this turtle specimen was even more extraordinary.

Collecting a whole turtle does not in itself pose any particular problems and can be carried out in the fashion in which paleontologists have been collecting large fossils for years. (See pages 18–19 to see how the turtle fossil was removed from the surrounding rock.) During the extraction process we did not see the true nature of the surface of the carapace of the turtle. It was not until we had dug the rock away from the turtle, encased the plastron in a plaster jacket (to ensure the specimen's stability), and flipped the turtle over that the unique color pattern was revealed. This was truly an exciting moment. We immediately recognized the importance of a preserved color pattern: no color pattern of a shell of a fossil turtle has ever been discovered. Thus, we realized, for the first time paleontologists will be able to reconstruct more accurately how this turtle looked in life.

The shape and arrangement of the bones in the turtle shell indicate that this turtle belongs to the extinct genus *Neurankylus*. This in itself is significant because it is the first fossil of *Neurankylus* identified from rocks of earliest Paleocene age in the San Juan Basin. (Previously, *Neurankylus* was well known from Upper Cretaceous strata, that is, Late Cretaceous age, and one specimen was known from somewhat younger Paleocene strata in the San Juan Basin.) *Neurankylus* belongs to a group of turtles referred to as selmaCryptodirans, and within this group it is one of many extinct forms of primitive freshwater turtles. These turtles flourished during the Late Cretaceous and early Tertiary, indicating that *Neurankylus* is one of the few reptiles that successfully survived the terminal Cretaceous extinctions.

The carapace is badly compressed and displays numerous fractures. A unique

and highly significant feature of the specimen, however, is that a portion of the epidermal covering of the carapace is preserved, and with it, *Neurankylus*'s spotted pattern. In living turtles the shell consists of two layers. The outer, or epidermal layer, is a relatively thin layer composed of separate plates (scales or scutes) composed of a keratinous (fingernail-like) substance. This layer contains the basic color pattern of the turtle's shell. It overlies the much thicker dermal layer, which consists of bones that are fused to each other and bear grooves. The borders of the epidermal scales and those of the dermal bone commonly do not correspond and, as a result, the edges of the overlying epidermal scales leave a trace of their borders impressed upon the surface of the underlying dermal bone.

The plastron of the fossil of *Neurankylus* we collected presented the situation usually encountered—dermal bone, weathered to a mottled gray, yellow, and brown color. However, approximately 85 percent of the carapace reveals what we believe to be the original color pattern of *Neurankylus*. This color pattern is one of numerous black spots that are two to five millimeters (one-fifth inch or less) in diameter against a reddish-brown field.

To determine whether the epidermal scales actually are present, Adrian Hunt, a graduate student in paleontology at the University of New Mexico, undertook a chemical analysis of the carapace. He cut a small piece of the carapace with a rock saw; the piece was in turn ground and polished until it was thirty microns

thick (one micron equals one one-thousandth of a millimeter or about .00004 inch). This "thin section" revealed that two layers are present in the carapace of *Neurankylus*: the outer layer contains the color pattern and is about 475 microns thick. It is a dense substance rich in iron, manganese, silicon, and calcium, much different from the underlying layer of fossilized dermal bone. We concluded that this outer layer of the *Neurankylus* carapace represents the fossilized epidermal layer. During the process of fossilization this layer was evidently replaced extensively by iron and manganese. This replacement apparently fixed the color pattern, preserving a pattern of small, dark spots on a lighter background. Since the oxides of iron and manganese present in the carapace tend to be black, brown, and red-colored minerals, it seems unlikely that the living *Neurankylus* displayed the exact colors preserved on the fossil carapace. Instead, based on comparisons with living turtles, living *Neurankylus* was probably covered with dark spots that were brown or black against a much lighter reddish, yellow, or tan background.

Surprisingly, few living turtles display spotted color patterns. Of those that do, the pattern shown by *Neurankylus* (numerous dark spots on a light background) is seen most often in some living soft-shelled turtles (trionychids). These turtles live in large rivers or streams or in large lakes with soft sand or mud bottoms. The spotted color pattern lends camouflage to these bottom-dwelling turtles.

Was such a lifestyle characteristic of *Neurankylus*? We think so. Besides its color pattern, features of *Neurankylus* that suggest it was an aquatic, bottom-dwelling turtle are its large size (the shell we collected is forty-seven centimeters or eighteen inches long), heavily built and low-vaulted carapace, and long tail. And, unlike most of its turtle contemporaries, fossils of *Neurankylus* are usually found in mudstones and siltstones that were probably deposited in lakes. The shape of the turtle's shell and the stratum within which it was found both seem to indicate that this large aquatic turtle lived at the bottom of large lakes. The spotted color pattern, demonstrated for the first time by the San Juan fossil, would have been a useful adaptation for such a mode of life.

Robert M. Sullivan, Research Associate in Vertebrate Paleontology, has studied early Tertiary reptiles for more than a decade and has published many articles on fossil lizards, crocodilians, turtles, and dinosaurs. He concurrently is a Research Associate in Herpetology and Paleontology at the San Diego Natural History Museum and Adjunct Professor in Biology at San Diego State University. Spencer G. Lucas, Curator of Geology in the Department of Geology, University of New Mexico, Albuquerque, is a vertebrate paleontologist and stratigrapher whose research interests focus on the Mesozoic and early Cenozoic evolution of mammals and other vertebrates. He has conducted field research in the Cretaceous and Paleocene of the San Juan Basin since 1976.



First, the extent of the turtle was determined and loose, weathered fragments of the plastron and carapace were picked up and put into collecting bags. Then a trench was dug around the periphery of the turtle to eliminate unnecessary rock. With further trenching a pedestal was created under the specimen in preparation for applying a plaster jacket so that the specimen could be removed from the field and transported to the laboratory without suffering damage.



The partially fragmented shell of *Neurankylus* was discovered upside-down (belly-up) so that the plastron, which lacks the color pattern, was exposed. Because nearly complete turtles are relatively rare, this specimen merited collection, even though as originally exposed it gave no clue of the unique color pattern preserved on its carapace.



The exposed surface of the turtle was treated with Glyptal, a shellac-like hardener that penetrates the fossil and seals it. After the Glyptal coating had dried, the specimen was ready for the plaster jacket. Toilet paper was wetted and applied to the exposed plastral side of the turtle. Strips of burlap were cut and dipped into a mixture of water and plaster that hardened within a few minutes, forming a protective plaster jacket.

Artist's conception of living *Neurankylus*, some 63 million years ago.

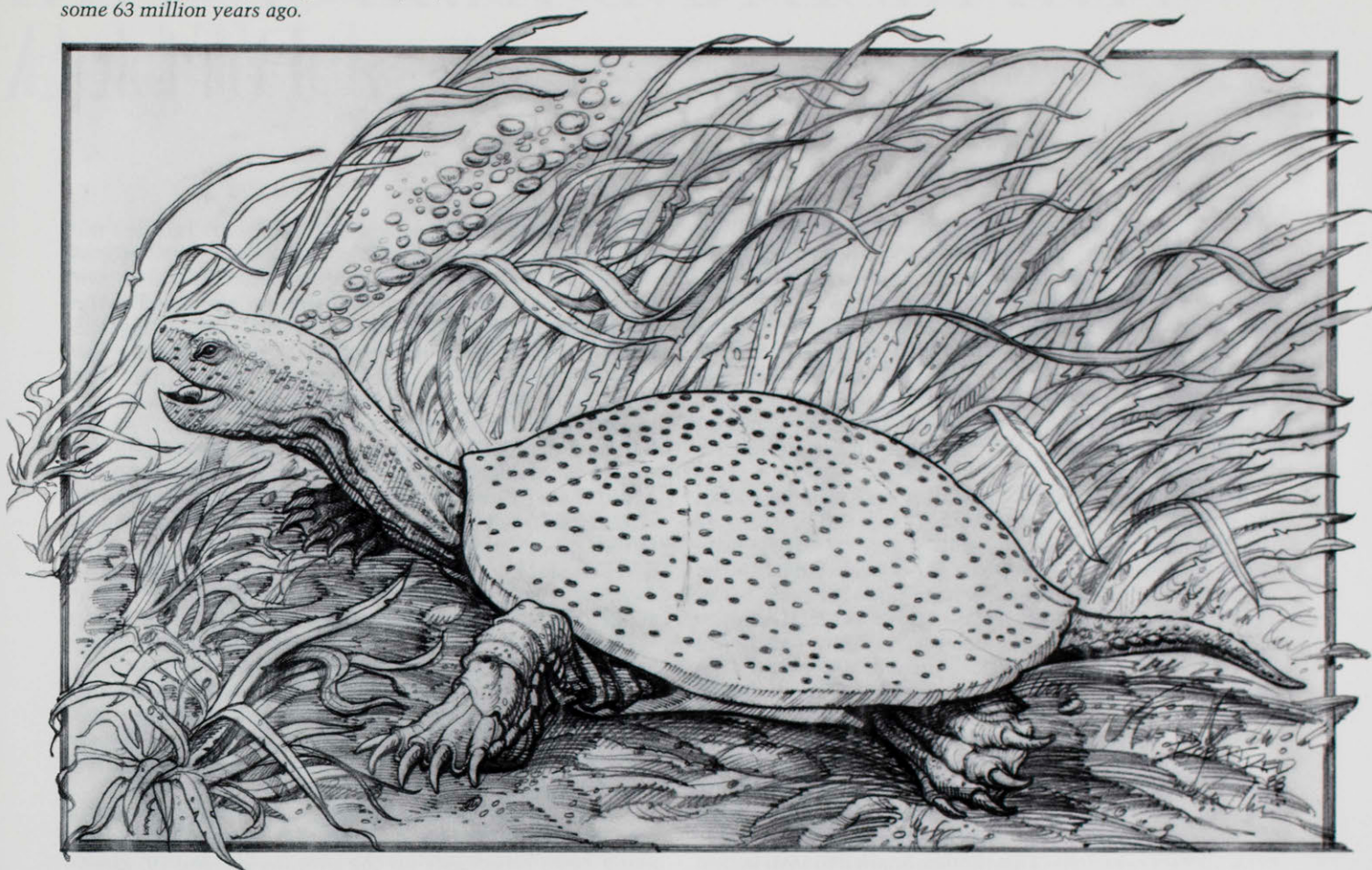


Illustration by Robert Reid



After the plaster jacket had dried and the jacket hardened, the specimen was flipped over, revealing its upper (carapace) side, thus righting the shell for the first time in some 63 million years and exposing the unique color pattern.



Because De-na-zin Wash is part of a federal Wilderness Area, no mechanized equipment or motor vehicles are allowed within its boundaries. Large fossils (such as a turtle) must be carried out on foot. A stretcher proved to be a convenient means of transport for this fossil turtle, which weighed some 60 pounds.



This close-up of a portion of the color pattern preserved on the *Neurankylus* carapace shows the dark spots on a lighter background. The dominance of red and black probably is, however, the result of iron and manganese oxides introduced into the shell during and after fossilization. In life, *Neurankylus*'s carapace was covered with dark brown or black spots against a much lighter reddish, yellow, or tan background. This color pattern is seen in some living soft-shelled turtles that inhabit the sandy or muddy bottoms of rivers, streams, and lakes. It is likely that *Neurankylus* lived in a similar environment.

THE RISE AND FALL OF THE Part 1: A

by WILLIAM J. BENNETTA

Creationism is a political arm of fundamentalism. The creationists seek to impose onto the population at large, by political means, a body of religious beliefs derived from literal readings of the King James version of the Holy Bible—both the Old Testament and the New. The name *creationists* reflects their special emphasis on the creation narratives in the Book of Genesis, their insistence that these be presented in public schools as accurate reports of historical events, and their correlative insistence that any contrary findings of science be suppressed.

In the summer of 1981, creationists in Louisiana secured the enactment of a statute authorizing the teaching of "creation-science" in the schools of that state. The term *creation-science* denotes a pseudoscience that creationists have been using as a strategic device since the early 1970s. This pseudoscience purports to furnish technical validation for prominent episodes in the Bible and hence for various fundamentalist doctrines. It also purports to refute evolutionary views of the universe, of Earth, and of living things.

The Louisiana statute said that evolutionary science and "creation-science" were to receive "balanced treatment": If a school's teachers or textbooks or library materials offered information about evolution, they would have to make a countervailing presentation of "the scientific evidences for creation." This dictum applied to instruction and materials dealing with the humanities as well as the sciences. A curriculum for presenting "creation-science" would be devised with the help of seven "creation-scientists," who would be chosen by the governor.

On June 19, 1987, the Supreme Court of the United States, ruling in the case of *Edwards v. Aguillard*, declared the statute to be unconstitutional.

The Louisiana creationists had sought to defend the statute by asserting that "creation-science" was not religious but scientific and that "balanced treatment" would enhance academic freedom. The Supreme Court had perceived that "creation-science" was not scientific but inescapably religious and that teaching it in public schools would violate the establishment clause of the First Amendment to the federal Constitution. That clause declares that the Congress shall make no law that would establish an official religion. The same prohibition was imposed on state legislatures by the Fourteenth Amendment adopted in 1868. The amendment had the effect of extending to the states most of the provisions of the Bill of Rights, which comprises the First through the Tenth Amendments.

The Court firmly rejected the creationists' invocation of academic freedom, observing that the statute did not engender any flexibility that teachers did not already have; that it actually reduced academic freedom by imposing a new constraint onto instruction about evolution; that it mandated the development of curriculum materials for teaching about "creation-science" but not for teaching about evolution; and that it erected protections for teachers who might choose to teach about creation but not for teachers who might choose to teach about evolution or about anything else.

In nullifying the Louisiana law, the Court fulfilled the expectations of many observers, including some prominent creationists. The more astute creationists had known for some years that the political strategy embodied in the Louisiana law was moribund. By the time when the Supreme Court ruled in *Edwards v. Aguillard*, they had already turned their attention back to the activities that historically had yielded creationism's most substantial, though least publicized, successes: attacks on local school boards, individual schools, and individual teachers.

Even so, the ruling was dramatic, for it unequivocally ended the creationists' long campaign to inject "creation-science" into schools through "balanced treatment" legislation. That campaign had attained various stages of development in various states of the Union. It had been the most conspicuous, and potentially the most destructive, element in the creationists' assault on public education.

The Louisiana case had become the crucial test of the entire undertaking, because the creationists in Louisiana had enlisted the boldest conceivable tactics for hiding the nature of "creation-science" and for circumventing the body of constitutional law that deals with the establishment clause. When they failed, the creationists' legislative campaign collapsed everywhere.

The Supreme Court's decision was reported prominently by the press. It inspired the opening stories for many news broadcasts on the evening of June 19, front-page articles in metropolitan newspapers on that evening or on the next morning, and major stories in the news magazines. Much of this reporting, though, was superficial and even misleading. Few reporters tried to convey the crucial history and significance of the Louisiana statute or the structure of the case that the statute had engendered. Typical stories concentrated on falsely comparing the Louisiana case to the Scopes case of 1925 (to which it bore no resemblance at all) and on quoting simplistic reactions to the Supreme Court's pronouncement, while ignoring the Louisiana case's central facts and grand theme.

Those facts and that theme deserve much attention, however. They teach some valuable lessons about creationism and creationists, and they are indispensable to an understanding of how and why the creationists are reshaping their attack on science education.

CREATIONISM AND "CREATION-SCIENCE"

The political goals of today's creationists are routinely underestimated by the popular press and the public, who still are influenced by memories of the creationists of the 1920s. Those early creationists, whose efforts led to the Scopes trial, had simple and narrow objectives: to stifle knowledge of biological evolution and to secure state laws that would ban that subject from schoolrooms and schoolbooks.

Today's creationists have a much broader, much bolder program. They seek to bring all of science education and all of science itself under fundamentalist control and censorship, and they hope ultimately to turn science into

LOUISIANA CREATIONISM LAW Bold Trick

what they believe it to have been a few centuries ago—a handmaiden of religion, devoted to confirming biblical stories and doctrines. They have conceived these brazen aspirations for two reasons.

First, the strategy of the early creationists was vitiated in 1968, when the Supreme Court ruled (in *Epperson v. Arkansas*) that a state could not outlaw instruction in evolutionary biology. Evolution was a matter of science, the Court said, and censoring science to promote religion was unconstitutional.

Second, creationists have come to recognize that information contradicting biblical literalism is prominent not only in biology but in a score of other disciplines—from physics, chemistry, and astronomy to geology, geography, archaeology, and linguistics. They have come to understand, then, that they must evict all meaningful education in science from the public schools and that they must chain and gag science itself.

With those distant goals in mind, the creationists strive to undermine the public's understanding of science's precepts, processes, findings, and achievements. Their principal efforts are aimed at influencing the development of curricula and textbook standards by state agencies and by local school districts. They seek the adoption of curricula and books that will conceal the nature and history of science, will depict science as a collection of arbitrary beliefs, will exclude or obfuscate various scientific topics (especially in astronomy, geology, paleontology, biology and anthropology), and will include servings of "creation-science."¹

"Creation-science" can be traced to fundamentalist writings of sixty or seventy years ago.² It has been developed most vigorously during the past twenty years or so, however, by religious groups that display names like the Institute for Creation Research, the Creation Research Society, the Creation-Science Research Center, and the Bible-Science Association. It has been presented and promoted in many publications by creationists³ and has been analyzed and exposed in many publications by scientists.⁴

In principle, "creation-scientists" may undertake to verify anything that reflects fundamentalist religious beliefs; and indeed, the range of subjects that they have addressed is very broad—astonishingly broad if we notice that active, identifiable "creation-scientists" seem to number no more than one hundred. One recent "creation-science" publication told how fossils and Bible-reading both showed that all the dinosaurs had been created as herbivores.⁵ (Carnivores would have upset the peace and perfection of the Garden of Eden.) Another contemplated whether and why God had devised pathogens that cause things like measles, polio, and smallpox.⁶ (No, God had not created harmful microbes. But after humans became sinful, God may have ordered some bacteria and viruses to begin expressing "already-created characteristics which result in disease.") A third wondered whether Earth might be the center of the solar system and of the whole universe, after all. (The case seemed strong: A gyroscope would work even if Earth were standing still; Descartes never had accepted heliocentricity; and Joshua had commanded the sun, not Earth, to stop.)

Other essays in "creation-science" have considered whether dyslexia is a relic of the debacle at the Tower of Babel, whether plants really are alive and capable of dying, and whether comets and other celestial objects are remnants of a watery "canopy" that the biblical god placed over the newly created Earth. (See the article on page 23.)

Despite this impressive diversity, however, most of "creation-science" is devoted to supporting a few major doctrines: that the universe was created supernaturally, from nothing, only a few thousand years ago; that living things were created, and persist, as separate and immutable "kinds" (a term from the King James translation of Genesis); that organic evolution, if it occurs at all, can merely cause minor variations in the kinds; that humans and apes are different kinds, separately created and quite unrelated; and that many phenomena of geology, including the fossil record, were generated during the great flood described in Genesis 7 and 8.

All the exercises of "creation-science" revolve around a simple, false dichotomy. All of them assume axiomatically that there are precisely two possible ways to explain nature and that the two ways are comparable but mutually exclusive. One way comprises the Bible's descriptions of supernatural acts and events. The other way comprises the explanations offered by contemporary science. One of these must be quite right, the other quite wrong.

Equipped with those axioms, "creation-scientists" generally eschew laboratory research and field work. (Prominent exceptions occur in their vigorously publicized hunts for the remains of Noah's ark⁸ and for fossilized footprints that would show that humans and the great dinosaurs lived, very recently, side by side.⁹) Nor do "creation-scientists" give much attention to building coherent explanations of the natural world. Instead, they devote most of their efforts and their publications to finding presumed defects in science and especially in the science of the past 150 years.

These defects include such things as unanswered questions, disagreements among scientists about the interpretation of data, and the revision of prevalent theories to reflect new information. While scientists regard such things as necessary parts of the scientific enterprise, "creation-scientists" depict them as failures of that enterprise and as de-facto endorsements of biblical literalism.

"Creation-science" exists today in two versions. One of these, for use in fundamentalist ministries, is explicitly biblical. It continually invokes biblical personages, events, and beliefs, often with citations of biblical chapters and verses. The other version is secular. It presents the same material but omits the citations, omits proper nouns, and uses some obfuscatory synonymy—such as "a catastrophe" or "a worldwide catastrophe" to denote the biblical flood.

The secular version was developed specifically as a device for carrying a fundamentalist view of nature into public schools, where it would neutralize evolutionary views. Some "creation-science" publications, in fact, exist in two editions: a "general" or "Christian school" edition that is explicitly biblical, and a "public school" edition that is ostensibly secular.¹⁰

In the summer of 1981, creationists in Louisiana secured the enactment of a statute authorizing the teaching of "creation-science" in the schools of that state.

In trying to get their pseudoscience into public schools, the creationists advocate what they call the "two-model" approach.¹¹ As its name tells, this is a political extension of their axiomatic dichotomy. There are two "models" for explaining nature, they say, and science education must accord equal representation to both. They refer to this as "balanced treatment," and the Louisiana legislature used the same term in its "creation-science" statute.

ORIGIN AND THEME OF THE LOUISIANA CASE

The Louisiana statute was founded on a bold trick. The Louisiana creationists foresaw that any description or documentation of "creation-science" would identify it as a restatement of biblical religion, so they produced a law that promoted the teaching of "creation-science" but refused to say what "creation-science" was.

Everything that followed, from the day when the statute was adopted until the day when it was nullified by the Supreme Court, sprang from efforts to sustain that trick. For several years the people defending the statute posed as the champions of an intellectual endeavor—a science—so important that it deserved to be installed in public schools by force of law. They refused, however, to tell what that science was or how anyone could learn about it.

This remarkable history began in 1980, when bills promoting the teaching of "creation-science" were sponsored in the legislatures of both Louisiana and Arkansas. The two bills were similar, for both had been derived from a model written at the Institute for Creation Research. Both bills mandated "balanced treatment" for "creation-science" and "evolution-science." Both defined "creation-science" by listing, in secular terms, some of its tenets. These included the statements that the universe had been created suddenly and from nothing, that the universe and Earth and living things had come into existence only recently, that plants and animals existed as created "kinds," and that Earth had undergone a worldwide flood.

The Arkansas bill became law in March 1981. In May it was challenged as unconstitutional in a suit filed in the federal district court at Little Rock.

As soon as that suit was filed, the sponsors of the Louisiana bill (which still was pending) sterilized their text. They excised the descriptive definition of "creation-science," and they replaced it with one sentence: "'Creation-science' means the scientific evidences for creation and inferences from those scientific evidences." They said nothing about the meaning of "creation."

The sterilized bill became Louisiana law in July 1981, and it too was challenged promptly as a violation of the First Amendment. The plaintiffs included educators, religious leaders, and parents of public-school students. Their suit—filed at Baton Rouge, in the U.S. District Court for the Eastern District of Louisiana—named the Louisiana Department of Education and several Louisiana officials as defendants. It asked the court to enjoin implementa-

tion of the new statute. The case acquired the title *Aguillard v. Treen*. The namesake plaintiff, Don Aguillard, was a public-school teacher; David C. Treen was Louisiana's governor.

The Arkansas "balanced treatment" statute was nullified in January 1982, after a trial that had spanned 11 days. In declaring the statute to be unconstitutional, Judge William Overton produced a long, analytical opinion telling that "creation-science" failed as science and was simply biblical literalism in disguise. Here is a part of his explanation of why "creation-science," as described in the statute's Section 4(a), did not meet the essential characteristics of science:

First, the section revolves around 4(a)(1) which asserts a sudden creation "from nothing." Such a concept is not science because it depends on a supernatural intervention which is not guided by natural law. It is not explanatory by reference to natural law, it is not testable and it is not falsifiable.

If the unifying idea of supernatural creation by God is removed from Section 4, the remaining parts of the section explain nothing and are meaningless assertions....

Section 4(a)(5) refers to "explanation of the earth's geology by catastrophism, including the occurrence of a worldwide flood." This assertion completely fails as science. The Act is referring to the Noachian flood described in the Book of Genesis....

The methodology employed by creationists is another factor which is indicative that their work is not science. A scientific theory must be tentative and always subject to revision or abandonment in light of facts that are inconsistent with, or falsify, the theory. A theory that is by its own terms dogmatic, absolutist and never subject to revision is not a scientific theory.

Overton's analysis immediately was recognized as the definitive exposition of "creation-science," and it soon was reprinted in a number of publications.¹²

Arkansas did not appeal.

In Louisiana, the federal district court's consideration of *Aguillard v. Treen* was delayed while the Louisiana Supreme Court studied a suit alleging that the "balanced treatment" statute violated the Louisiana Constitution's grant of authority to the state's board of education. The Louisiana court ruled in 1983 that there was no violation. The federal district court could now consider the First Amendment challenge.

The plaintiffs asked the district court to use summary judgment, a mechanism by which a court can decide a case without convening a trial. Summary judgment is subject to several constraints, and one of them is this: it can be employed only if the case to be decided presents no significant questions of fact.

In seeking summary judgment, the plaintiffs contended that the only facts needed for assessing the constitutionality of the Louisiana statute were the meanings of "creation" and "creation-science" and that these were beyond questioning: "creation" meant a religious concept involv-

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Illustration by R. M. Kato

What *Did* Noah Do with the Manure?

Jack Hitt, a professional writer, wondered what children might have to learn in science classes if Louisiana's creationism law were put into effect. To find out, he surveyed several years' issues of a "creation-science" periodical that has been issued since 1964: the *Creation Research Society Quarterly*. Hitt then described some of his discoveries in *The Washington Monthly* for February 1987, in an article titled "What *Did* Noah Do with the Manure? and Other Burning Questions of Creation Science." Here is an excerpt.

CREATION LINGUISTICS

Lance B. Johnson, a retired optometrist who now directs Come & See Ministries, describes in "The 'Tangled' Tongue" in the December 1982 issue [of the *Quarterly*] how he had suspected that dyslexia was directly connected with the Tower of Babel. According to Genesis 11:4-9, the tower was erected for the purpose of reaching heaven. This incurred the wrath of God, who, as punishment, made the builders' speech mutually unintelligible. After the Tower's fall, Johnson argues, people were genetically programmed to read either left to right or right to left.

Those who are programmed to reach one way, but grow up in a culture that reads the other, wind up being dyslexic.

One day a patient came into Johnson's office to be fitted for glasses and to discuss her dyslexia. It was then, he maintains, that he discovered his proof. In casual conversation she mentioned how odd it was that she had studied Hebrew and had excelled in it. "I nearly fell out of my chair!" he reports. "'Praise the Lord,' I thought." More proof came later: "Then, to cap it off beautifully, she said her ancestry was Jewish!"

CREATION PHYSIOLOGY

If death came with original sin, as Paul says, then the scientific corollary is that nothing in the Garden of Eden could have died until Adam took a bite out of the apple. "What did they eat until then?" wonders John W. Klotz, who is also the director of graduate studies at Concordia Seminary, in the March 1980 issue. If they ate a plant, wouldn't they have to kill it?

In his article, "Is the Destruction of Plants Death in the Biblical Sense?" Klotz says this problem is solved in the Scripture when God

bles man and animals and instructs them to "be fruitful and multiply." God didn't tell the plants to "be fruitful," so "the blessing added in the account of the creation of animals sets them apart from the plants." Klotz also adds that since the nucleus of a plant cell hugs the cell wall, while animal nuclei kind of bob around in the middle, eating plants "may not have involved 'death' in the Biblical sense of that term."

CREATION COSMOGRAPHY

Some creation scientists argue that the Flood resulted from the collapse of a massive amount of water suspended high in the atmosphere, sometimes called the "vapor canopy." David W. Unfred, who is also director of external studies at Christian Heritage College, hypothesizes in a September 1984 article, "Asteroidal Impacts and the Flood Judgment," that the postdiluvian detritus of this canopy could explain most of what is hurtling through space. "It is possible," he writes, that the "comets, asteroids, meteorites, and outer planetary moons (and planets?), excluding the uniquely created Earth and Moon, are remnants, a reminder, of the pre-Flood 'waters above.'"

Gary L. Johnson sets forth a far more detailed explanation in his September 1986 "Global Heat Balance with a Liquid Water and Ice Canopy." According to his calculations, the canopy consisted of "large water globules at about a 2 kilometer altitude over equatorial regions and large ice fragment clouds at about a 2200 kilometer altitude over the polar regions." This two-tiered canopy, he says, may explain the peculiar climate after the Creation.

At first the Earth was warm, with no fluctuations in temperature. Why? "Adam and Eve apparently did not need clothes (Genesis 2:25) for comfort, indicating a rather narrow temperature range." Moreover, it never rained until Noah, since rain is not mentioned in the Bible until then. Johnson has more proof. If "rain occurred before the Flood, the rainbow would have occurred also and would not have been useful as a sign."

At the time of the Flood, Johnson argues, the water globules burst, yielding the 40 days and nights of rain. The ice canopy remained. Meanwhile the world repopulated until the collapse of the ice canopy. This would have "buried the mammoths and permanently changed the climate of the polar regions," the source of what evolution scientists call the Ice Age.

The radical decline in the earth's average temperature that followed, Johnson writes, "would certainly have destroyed any remaining dinosaurs." Since creationists believe Earth is only about 6,000 years old, they account for dinosaurs by claiming that they lived side by side with man during a kind of Flintstonian Epoch that ended after some cataclysm—possibly the collapse of the ice canopy described here—destroyed the large beasts.

There is one problem with this two-tiered canopy theory, the author notes: "It appears that a miracle is necessary for any canopy model, either to hold the water up or to get it down without destroying the earth."

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Most of "creation-science" supports a few major doctrines. One is that the universe was created supernaturally a few thousand years ago. Another is that the fossil record was generated during the great flood described in Genesis 7 and 8.

Continued from page 22

ing supernatural acts by a supernatural being; "creation-science" meant an identifiable body of religious doctrines, including those that had been listed in the Arkansas "creation-science" law and analyzed in the decision by Overton.

The defendants denied all this and opposed the granting of summary judgment. They asserted to the court that there were important questions about the intended meanings of "creation" and "science" and "creation-science" and that the resolution of these questions would require a trial. They even explicitly denied that the "creation-science" of the statute revolved around a creation from nothing, a worldwide flood, or any of the other tenets that had been cited explicitly in the statute's original text.

STRATEGY OF THE DEFENSE

In that denial the creationists announced the strategy that they would use at every step, all the way through the U.S. Supreme Court. Extending the technique used by the Louisiana legislature, they simply would refuse to say what "creation-science" was. They would, however, tell insistently what it was *not*.

The result was bizarre. The creationists ultimately produced hundreds of pages asking the courts to uphold the teaching of "creation-science," but they never told how "creation-science" could be identified, never cited any publication about it, never named any "creation-scientist," never cited a journal in which a "creation-scientist" had published a finding or an idea, and never identified an institution associated with "creation-science" work.

The only affirmative information that they offered in characterizing "creation-science" comprised some vague, even weird, statements suggesting that "creation-science" had to do with the "abrupt appearance" of natural entities "in complex form." (I shall quote some typical statements later.) They never told what "abrupt" meant, and they never told why they thought that an interest in abrupt events was unique to "creation-science" or could serve to identify it. Nor did they provide any comprehensible idea about the meanings of "creation" and "created," although they used those words often.

This "abrupt appearance" material was an after-the-fact invention, vague enough to be meaningless, by which the defendants, their allies, and their lawyers could pretend to be telling about "creation-science" while they actually were telling nothing at all. There was nothing in the legislative record to suggest that Louisiana's lawmakers ever had imagined "creation-science" to be an ill-defined fascination with abrupt appearances, and there was much in the record to show that they had known "creation-science" to be a specific body of explicit doctrines.

The defendants embellished their allusions to "abrupt appearance" with declarations that "creation-science" involved such concepts as morphology and isomers and probability and anatomy and biomolecular systems and other arcane-sounding things, but the embellishment too

was meaningless. Morphology and isomers and all the rest of those things recur in various scientific disciplines, including disciplines that already were represented in Louisiana's science curriculum. Saying "morphology" or "isomers" did nothing to tell how "creation-science" could be recognized or how it could be distinguished from the "evolution-science" that it was to counterbalance. The creationists' invocation of such terms merely amplified the spectacle provided by their refusal to explain the terms that mattered: "creation-science" and "creation."

That spectacle was complemented by another: the defendants' effort to propagate false ideas of what "creation-science" was *not*. This effort had three parts. The first was to convey that Louisiana-style "creation-science" was *not* a religious endeavor of any kind. The second was to convey specifically that Louisiana-style "creation-science" was *not* Arkansas-style "creation-science" (which already had been declared, in the unappealed decision by Overton, to be religion in disguise). For both of these tasks, the defense lawyers enlisted simple assertions. They simply announced that *their* "creation-science" was not religious, that the "creation" in its name was not a religious concept, and that it did not require doctrines like the ones that had been listed in the Arkansas law. They did not try to support these announcements with evidence.

The defense lawyers' third task was to convey specifically that Louisiana-style "creation-science" was *not* orthodox "creation-science"—the well-documented religious enterprise that had been elaborated for at least two decades, in scores of publications, by the Institute for Creation Research, the Creation Research Society and other fundamentalist groups.

The tactic that they adopted here was wonderfully brash: they ignored orthodox "creation-science" entirely, as if it could not possibly be relevant to the case. They never abjured it, they never acknowledged it, and they surely never explained how their own "creation-science" had come to share its name. For them, the Institute for Creation Research and the Creation Research Society seemed not to exist.

A proper appreciation of the defense's performance requires knowledge of some auxiliary facts:

- The defense was led by Wendell Bird, a lawyer from Georgia who was functioning as a special assistant attorney general of Louisiana. In one of his earlier roles, Bird had been the chief lawyer for the Institute for Creation Research.

- Although the defense was conducted in the name of Louisiana, the money that supported it came from a private body: the Creation Science Legal Defense Fund, headquartered in Shreveport. The fund's motives and goals, as expressed in its solicitation letters, were overtly religious. The fund called itself a "ministry" and sold fundamentalist tracts by mail.

- The fund's "Board of Reference," listed on its letterhead, included two men who were officers and employees of the Institute for Creation Research, as well as people affiliated with the Creation Research Society or the Bible-Science Association.

- The principal exposition of "creation-science" offered

The Louisiana statute was founded on a bold trick. Any description of "creationism" would identify it as a restatement of biblical religion, so creationists produced a law that promoted the teaching of "creation-science" without defining what "creation-science" was.

to the Louisiana legislature, before the adoption of the statute, had come from a fundamentalist group called the Pro Family Forum. Representatives of the forum, urging adoption, had proffered a list of seven books that might be used for training teachers in "creation-science." One of the books had been issued by the Creation Research Society. The rest had come from the Institute for Creation Research or from its publishing affiliate, which has been known as Creation-Life Publishers, Master Book Publishers, Master Books, and CLP, Inc., among other names. The legislative record showed that the forum had described "creation-science" in terms of a worldwide flood, "kinds" of plants and animals, and a "relatively recent inception" of Earth. (The record also showed, of course, that those items had appeared in the original text of the Louisiana statute but later had been excised.)

THE AFFIDAVITS

To bolster their representations about Louisiana-style "creation-science," the defense submitted five affidavits to the district court. All five were irrelevant to the case, as the Supreme Court eventually would explain quite clearly. They were irrelevant because they had been written after the adoption of the Louisiana statute and because the people who had written them had taken no part in the Louisiana legislature's deliberations. Hence they could signify nothing about the legislature's intent or about what the legislators had thought "creation-science" was.

Despite this, the affidavits were engaging documents. They told with admirable clarity that the defendants' case was a sham, and they said a great deal about creationists and about the people who lie down with creationists.

The outstanding property of each affidavit, and of the five taken together, was that no affiant claimed knowledge of "creation-science." Each affiant wrote about "creation-science," giving assurance that it was not religious, that it was a mere preoccupation with abrupt events, and so forth; but no affiant suggested how he had learned any of this. No affiant said that he himself was a "creation-scientist." No affiant named a "creation-scientist" whom he had consulted, or even one whom he had not consulted. No affiant named any "creation-science" publication that he had seen, or even one that he had not seen. In every affidavit, as in everything else that the defense produced, every statement about "creation-science" was just a naked assertion.

This was especially striking because each affidavit began with formal, enumerative statements about the affiant's education, experience, and attainments. No affiant showed any education, experience, or attainments in "creation-science."

Two affidavits were very short and did not even try to define "creation-science." One was provided by Robert J. Clinkert, an assistant superintendent of an unspecified school district in Illinois. The other came from William G. Most, a theologian at Loras College, a Catholic school in Iowa. The theologian avoided the nature of "creation-

science" but gave a few words to creation: "The concept of creation is not inherently religious and is nonreligious when defined as abrupt appearance in complex form. The concept of a creator is also not inherently religious, although it can be stated in religious terms; and it is not religious in its relation to creation-science." That was all that he said about it. He did not suggest whether he had considered what a "creator" might be if "creation" meant nothing more than abrupt appearance.

Of the three longer affidavits—those that ostensibly defined "creation-science"—one came from Terry Miethe, who called himself a philosopher and theologian. "Creation-science," Miethe wrote, "refers to abrupt appearance in complex form of biological life, life itself, and the physical universe." If his definition seemed obscure, that would be too bad; he had nothing more to say about the matter. He added, however, that "creation-science" had "changed in content over the past decade." He did not describe the original content, the new content, or the change.

The outstanding feature of Miethe's affidavit was his failure to tell where he was working. This was remarkable because his biographical introduction gave many other details, including his grade-point averages at two schools. As it happened, and as eventually would be told during proceedings in the U.S. Supreme Court, Miethe worked at Liberty University (in Lynchburg, Virginia), a Bible college operated by the fundamentalist preacher Jerry Falwell.

W. Scot Morrow, who teaches chemistry at Wofford College (in Spartansburg, South Carolina), wrote an affidavit that said this:

Creation-science is a scientific model or hypothesis that attempt[s] to account for the "origins" of material entities or systems in our world by means of their *relatively sudden or abrupt appearance* in complex form with the passage of time. It is intrinsically non-gradualist in emphasis, and relies strongly on catastrophic events occurring in nature, rather than uniformitarian alternatives [emphasis in the original].

Morrow, who said that he was neither a creationist nor a fundamentalist, did not explain "creation," although he did not hesitate to use that word. The focus of his effort comprised four short paragraphs, each stuffed with science words, that purported to describe biological creation, biological evolution, biochemical creation, and biochemical evolution. Here is the whole text of one such paragraph:

Biochemical Creation. Biochemical creation also is based on plausible scientific data and analysis, and does not involve religious concepts. This evidence and analysis includes information content (which is immense in simple organisms and their genetic coding systems), probability (which is minuscule for biochemical evolution), isomers (which can be said to point to creation), and thermodynamics (involving entropy considerations).

Had the "evidence and analysis" come from "creation-scientists"? Why could isomers "be said to point to creation"—whatever creation was? Did entropy considerations and isomers and probability have something to do with "abrupt appearance"? Morrow did not say.

The Supreme Court perceived that "creation-science" was not scientific but inescapably religious.

The longest, most revelatory affidavit came from Dean H. Kenyon, who teaches biology at San Francisco State University. Kenyon embraced fundamentalist religion some years ago, and since then he has become a prominent and unique attraction in the creationists' show. He is a member of a respectable department of science, but he explicitly has endorsed various tenets of "creation-science"—that the Bible is inerrant, that the universe was created supernaturally and recently, and that fossils are relics of a worldwide flood.^{13, 14}

In 1981, Kenyon went to Little Rock to testify in defense of the Arkansas "balanced treatment" law, though he then left town before he could be called as a witness.¹⁵

In 1982, he contributed the foreword to a book by two leaders of the Institute for Creation Research. The book was called *What Is Creation Science?*¹⁶

When he wrote his affidavit for the Louisiana case, however, Kenyon seemed unable to give any lucid answer to the very question that the book's title had posed. "Creation-science," he said, "means abrupt appearance in complex form, and includes biological creation, biochemical creation (or chemical creation), and cosmic creation." He saw no need to define "creation."

Kenyon next made some assertions about what "creation-science" was *not* and did *not*. (These included the assertion that it did not have catastrophism among its essential elements—a revelation that might have surprised W. Scot Morrow.) Then he undertook a long essay that consisted almost wholly of material that had appeared often in secularized publications of the Institute for Creation Research. The essay provided many treats for the careful reader, and I should note a few.

Either plants and animals evolved from one or more initial living forms (biological evolution), or they were created (biological creation). Either the first life evolved from nonliving molecules (biochemical evolution), or it was created (biochemical creation).

But what did "creation" *mean*? Did it mean abrupt appearance? If so, did "was created" mean "was abruptly appeared"?

The striking anatomical similarities, e.g., in skeletal structure, among the vertebrates are interpreted by evolutionists to be indications of common ancestry. ... Creationists, on the other hand, see the same data as evidence of a common structural plan or of basic conditions for life.

Kenyon seemed to not know that evolutionary scientists regard anatomical similarities as evidence of a common structural plan, just as surely as creationists do. The difference between the scientists' view and the creationists' view would have been clear if Kenyon had told how creationists *explain* the common plan: they say that it bespeaks a supernatural inventor who adopted a limited number of designs, then varied them somewhat as he invented different organisms.¹⁷

It is possible that new species, genera, and occasionally even families, may have arisen by natural means since the occurrence(s) of creation,

By counterposing "natural means" and "creation" Kenyon disclosed the very thing that the creationists were

trying so hard to conceal: whatever "creation" was, it was not natural. It was supernatural, and "creation-science" was supernaturalism.

PROCEEDINGS IN THE DISTRICT COURT

On January 10, 1985, Judge Adrian Duplantier, of the district court in Baton Rouge, granted summary judgment for the plaintiffs and declared the Louisiana statute to be unconstitutional. He found that the statute showed no legitimate secular purpose—as a law must do if it is to survive the First Amendment's rule against the establishment of religion—and that it had been devised solely to promote a religious doctrine. His opinion said, in part:

Whatever "science" may be, "creation," as the term is used in the statute, involves religion, and the teaching of "creation-science" and "creationism," as contemplated by the statute, involves teaching "tailored to the principles" of a particular religious sect or group of sects [a thing proscribed by the Supreme Court's ruling in *Epperson v. Arkansas*]. As it is ordinarily understood, the term "creation" means the bringing into existence of mankind and of the universe and implies a divine creator. ...

The state may not constitutionally prohibit the teaching of evolution in the public schools, for there can be no non-religious reason for such a prohibition. ... If the state cannot prohibit the teaching of evolution, manifestly it cannot provide that evolution can be taught only if the evolution curriculum is "balanced" with a curriculum involving the tenets of a particular religious sect. ...

The defendants promptly appealed to the U.S. Court of Appeals for the Fifth Circuit, in New Orleans.

PROCEEDINGS IN THE COURT OF APPEALS

The case reached the appeals court under the title *Aguillard v. Edwards*, for the governor of Louisiana was now Edwin W. Edwards.

In their argument to the court, the lawyers defending the "balanced treatment" statute asserted again that the case presented unanswered questions of fact. They insisted that the district court's granting of summary judgment, therefore, had been an error. They pointed to their affidavits, and they emphasized that these had not been controverted by the plaintiffs. (This was true. The plaintiffs knew that the affidavits were worthless and that replying to them might dignify them, blur their irrelevance to the case, and open the case to issues that otherwise would not exist.)

A panel of three judges considered the appeal, and their decision was issued on July 8, 1985: The judgment of the district court was affirmed.

The panel's opinion noted, among other things, that the Louisiana statute showed its lack of secular purpose by its

The Supreme Court's ruling unequivocally ended the creationists' long campaign to inject "creation-science" into school through "balanced treatment" legislation.

failure to promote "creation-science" as a genuine subject for academic study:

If primarily concerned with the advancement of creation-science, the Act, it certainly appears to us, would have required its teaching irrespective of whether evolution was taught. Thus a primary academic interest in creation-science would seem to be gainsaid because the Act requires the teaching of the creation theory [sic] only if the theory of evolution is taught.

Finally, this scheme of the statute, focusing on the religious *bête noire* of evolution, as it does, demonstrates the religious purpose of the statute. Indeed, the Act continues the battle William Jennings Bryan carried to his grave. The Act's intended effect is to discredit evolution by counterbalancing its teaching at every turn with the teaching of creationism, a religious belief. The statute therefore is a law respecting a particular religious belief....

The defense now submitted a suggestion for a rehearing *en banc*—a reconsideration in which the appeal would be weighed by all the judges on the court, rather than by a panel of three. This suggestion itself was weighed by the full court, and it was denied by a narrow margin: 8 to 7.

The denial, issued on December 12, comprised one paragraph but was accompanied by a long dissent presenting the view of the seven-judge minority. The dissent had been written by Judge Thomas Gee, who apparently had credited all that the creationists had offered—from the idea that there were only two views of "origins" to the notion that some of the creationists' affidavits had come from "highly qualified scientists." Gee believed that the Louisiana statute required only "that the whole truth be taught," and he thought that the teaching of science without "creation-science" would be the teaching of half-truths.

To advocates of sound education in science, the fact that seven judges had joined in the dissent was disheartening. It underscored the tenuous status of an education system that is subject to officials who themselves have not had, or cannot apply, a competent education; and it showed that, in the Fifth Circuit, official ignorance dwelt in some rather high places. When petty politicians or local school-board members are gulled by "two model" nonsense, or show that they have no idea of what science is and how it operates, or imagine that anyone who uses unfamiliar words must be a learned scientist, these things are deplorable but not really surprising. When federal judges do such things, however, we must be surprised and alarmed.

On December 20, 1985, a week after the narrow defeat in the court of appeals, the creationists took their case to the Supreme Court.

In Part 2 of this article, to be published in our next issue, William J. Bennetta will describe proceedings in the Supreme Court and will tell how the Court struck the Louisiana law down. Then he will explain the principal methods by which the creationists, deprived of their "balanced treatment" strategy, will continue their assault on science education in the public schools.

William J. Bennetta is a scientific consultant, a professional editor, and a fellow of the California Academy of Sciences. His interests include evolutionary biology, the interactions between biology and public policy, and the influence of the press on the public's understanding and misunderstanding of science.

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tory and inhabitants, familiarizing them with cultural and scientific resources that will benefit them throughout their lives. With the support of ARCO and Northern Trust, these programs will bring new audiences to the museum, representing a broad cross-section of Los Angeles's large and diverse community.

Australian Sponsorship for Kadimakara. The museum gratefully acknowledges the support of Paul Hogan and the Australia & New Zealand Bank for their sponsorship of **Fossils of the Australian Dreamtime: Kadimakara**. The exhibit, a prehistoric menagerie of extinct animals from the land down under, is the most comprehensive one of its kind ever to travel outside of Australia. Many thanks to Paul Hogan and the Australia & New Zealand Bank for bringing Australia closer to California!

Occidental Petroleum Corporation and Coldwell Banker Fund Treasures of the Tar Pits. Occidental Petroleum Corporation and Coldwell Banker have generously supported **Treasures of the Tar Pits**, the museum's seventy-fifth-anniversary national touring exhibition. The exhibit brings together some of the finest specimens from the museum's world-famous collection of Ice Age fossils from Rancho La Brea. After its month-long run at the Natural History Museum from August 16 through September 18, the exhibition is scheduled to tour the United States and Canada (for more details, see "Museum on the Move" in the March/April issue of *TERRA*). The museum is grateful to Occidental Petroleum Corporation and Coldwell Banker for giving **Treasures of the Tar Pits** a strong local send-off.

N. W. Ayer Puts Ideas to Work for Seventy-Fifth Anniversary; Patrick Media Group, Hughes Markets, and Trader Joe's Lend a Hand. Thanks to the creative teamwork of N. W. Ayer's Paul Wilcox, Laura Greenburg, and Bianca Juarez, and help from Patrick Media Group, Hughes Markets, and Trader Joe's, the Natural History Museum is receiving excellent visibility for its seventy-fifth-anniversary year.

Ayer's **Hollywood: Legend and Reality** billboard, which stood on Exposition

Boulevard and Vermont Avenue from December 1987 through February 1988, used the larger-than-life image of Marilyn Monroe from *The Seven Year Itch* to convey the exhibit's nostalgic appeal. Billboard space was generously donated by Patrick Media Group.

Referring to the **Hollywood** show as "An Event of Epic Proportions," Ayer used the Hollywood sign as the central motif in its design for a shopping bag that was printed and distributed courtesy of Hughes Markets.

The museum's familiar saber-tooth cat logo was the central image in Ayer's royal blue design for special seventy-fifth-anniversary shopping bags, which were printed and distributed courtesy of Trader Joe's.

New Fellows Welcomed. The museum gratefully welcomes the following new Fellows who have contributed \$1,000 or more this year in support of exhibition and education programs:

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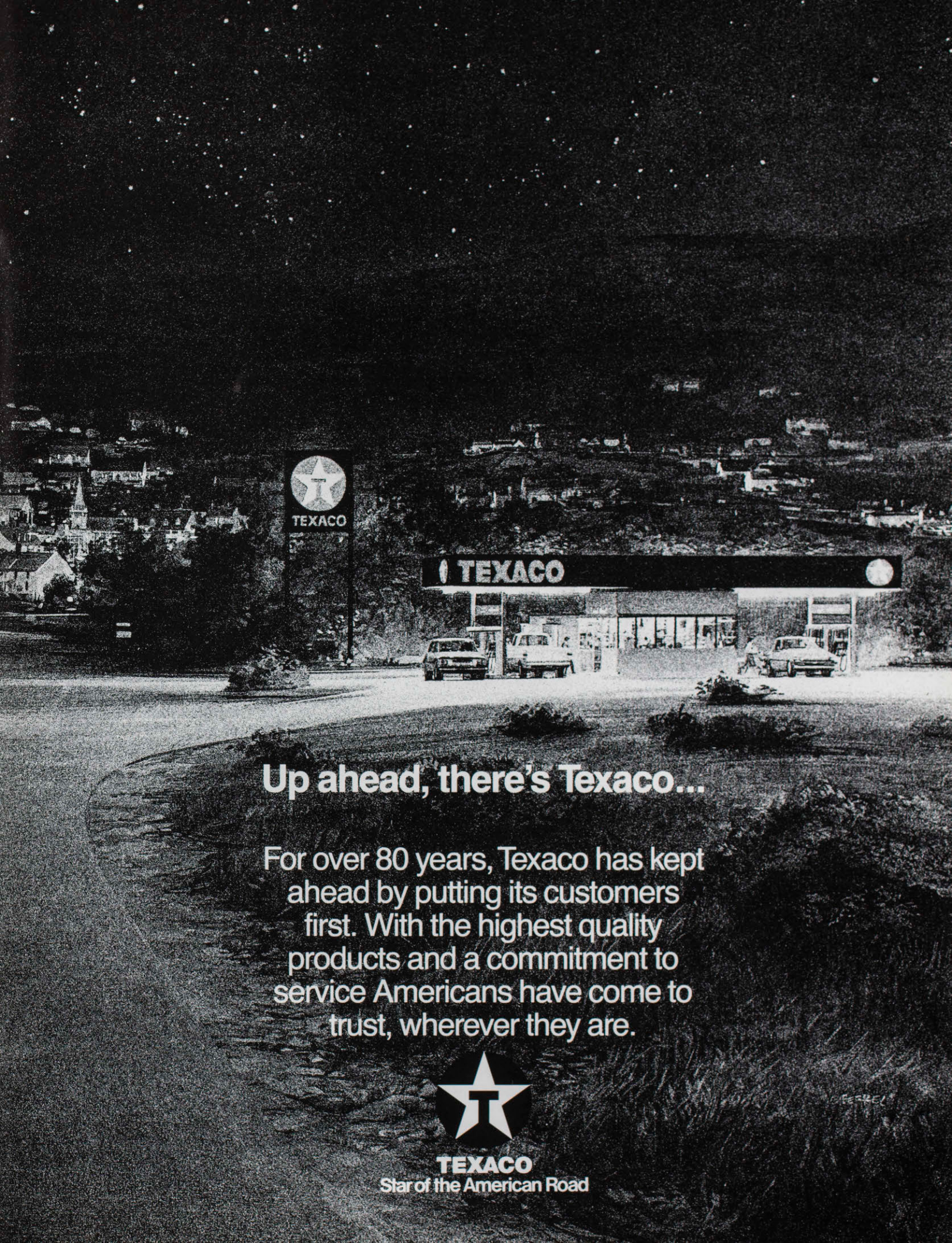
Daniel Pang, Tippi Hedren, Mae Hi, George Takei, and Dr. Peter Keller were among those who ushered in the Year of the Dragon at a museum Fellows luncheon at Universal City's Fung Lum Chinese restaurant. Photograph by Donald Meyer.

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Times Mirror Hall of Native American Cultures Architect Jean-Jacques André and Leadership Committee Chairman William A. Mingst gave special guests an update on plans to construct the hall. Shown with a model of the hall are Stephen R. Onderdonk, President of the museum's Board of Trustees; Kay Onderdonk; Otis Chandler, Vice Chairman of the Hall of Native American Cultures Leadership Committee; and Bettina Chandler. Photograph by Dick Meier.

Continued on page 30



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Continued from page 28

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Dick Meier

Carole Levinthal

Carole Levinthal Named Special Events Coordinator. Bringing with her a wealth of experience that includes six years as special events coordinator for the J. Paul Getty Museum, Carole Levinthal has been named special events coordinator for the Natural History Museum. In her most recent position, she was responsible for scheduling, organizing, and overseeing exhibition openings, concerts, meetings, seminars, tours, luncheons, and dinners for up to one thousand people. She previously served as the Getty Museum's director of public information.

Although Ms. Levinthal says that the challenge of her new position was sufficient inducement to join the Natural History Museum's staff, she calls the new environment "an added bonus" of the job. "I have always been passionately interested in animals and the natural world," she explains. "I can't think of a better place to work."

In Memoriam: Dr. Ralph W. Schreiber. Dr. Ralph W. Schreiber, the museum's Curator of Birds and Mammals, a leading ornithologist, and an internationally known specialist on Pacific seabirds, especially the Brown Pelican, died on March 29. He was 45.

Dr. Schreiber was unstinting in the energy he gave to the museum and to science: organizing exhibitions and an entirely new bird hall for the museum; writing many articles, both popular and scientific (including two for *TERRA* that he coauthored with his wife Elizabeth Anne, a museum Research Associate); teaching; speaking to the public and to the media; and encouraging the careers of young scientists.

At the museum Dr. Schreiber was responsible for all activities within the Birds and Mammals Section, including overseeing of organization, programs, and policies as well as research and collection management for the over 103,000 bird specimens and 90,000 mammal specimens in the museum's collections. He was a key member in the campaign for the new \$5.2 million Great Bird Hall, which began construction in June.

Dr. Schreiber had conducted research on Central Pacific islands for over two decades, including Christmas Island, Johnston Island, and Midway. He studied the avian fauna of Anacapa Island (in Channel Islands National Park) in the late 1960s as part of a Smithsonian team that made the original discovery that domestic, agricultural, and industrial use of DDT was affecting the Brown Pelicans nesting there. He became active in the fight to ban DDT, thus helping to save the endangered species.

In 1982 Dr. Schreiber and Elizabeth Anne Schreiber observed the devastating effects of El Niño, a periodic change in the Pacific Ocean atmosphere, on Central Pacific seabirds. The 1982-83 El Niño, with its very hot, nutrient-poor waters, caused a mass starvation of the seabird population. Their work proved for the first time that the El Niño condition had worldwide repercussions. Dr. and Mrs. Schreiber described the discovery of this phenomenon in an article in *Science*, a paper for which Dr. Schreiber was co-winner of the museum director's prize for best scholarly paper published during 1984.

Dr. Schreiber's research was supported by the National Science Foundation and the National Geographic Society as well as by other grants and private donors to the museum's Ornithology Research Fund. Prior to joining the museum in 1976, he was co-founder and president of



The late Dr. Ralph W. Schreiber banding a Masked Booby (*Sula dactylatra*) on Christmas Island. Dr. Schreiber's research with his wife Elizabeth Anne on Central Pacific seabirds resulted in a new understanding of the global effects of El Niño. Photograph by Elizabeth Anne Schreiber.

Seabird Research, Inc. Earlier he had been a founding partner in Biological Research Associates, Inc. and had done work for the Smithsonian Institution. He was Adjunct Associate Professor at the University of Southern California from 1977. He received his Ph.D. from the University of South Florida in 1974.

Dr. Schreiber was also a consultant to various agencies of the federal government, including the U.S. Fish and Wildlife Service, National Marine Fisheries Service, and the Defense Nuclear Agency and the Corps of Engineers on the avian populations and human influences on Johnston Atoll. He was active in a number of professional societies such as the American Ornithologists' Union, British Ornithologists' Union, Eastern Bird Banding Association, and the Cooper Ornithological Society.

A recipient of numerous honors and awards, Dr. Schreiber was widely published. He was editor or author of over one hundred scientific publications, fifteen popular publications, a half-dozen books, and many technical reports.

Surviving are his wife; parents, William I. and Clare Adel Schreiber of Wooster, Ohio; and three brothers, James L. of Wooster, William M. of Louisville, KY, and Stephen T. of Princeton, NJ.

The family requests that donations in Dr. Schreiber's memory be made to the

Natural History Museum's Ornithology Research Fund (900 Exposition Boulevard, Los Angeles, CA 90007).

Entomology Curator Elected Society President. Julian P. Donahue, Assistant Curator of Entomology in charge of the museum's Lepidoptera (moth and butterfly) collection since 1970, has been elected president by members of the Lepidopterists' Society. Mr. Donahue has held a number of important positions in the society prior to receiving this honor, including serving as secretary (for nine years) and program chairman and/or coordinator for eight regional, national, and international meetings. He is currently a member-at-large of the society's executive council, the assistant secretary in charge of maintaining the membership computer database, and the society librarian. The Lepidopterists' Society was founded in 1947 and is an international organization of over fifteen thousand members, amateur and professional, dedicated to furthering all aspects of the scientific study of moths and butterflies, the second largest order of insects.

National Science Foundation Grant Award to Malacology. The Biological Resources program of the National Science Foundation has awarded a three-year grant of \$169,261 to Dr. James H. McLean, Curator of Mollusks, for collection improvements to the Natural History Museum's malacology (mollusk) collection. Goals include the completion of curation of recently acquired collections and the complete rearrangement of the research collection of mollusks. Funding will be used to add a temporary position for a curatorial assistant and to purchase collection storage cases. The museum's mollusk collection has experienced rapid growth and is now the third largest in the country. It is particularly strong in marine mollusks from the eastern Pacific, ranging from Alaska to Chile.

Ichthyology Grants, Meetings, Travel, and Activities. Dr. Andrew E. Jahn has received funds from the Department of Beaches and Harbors, County of Los Angeles, for a one-year project to survey the biota of near-shore areas of Los Angeles County. He conducted field research at San Clemente Island in February, documenting the islands' intertidal flora and fauna, along with Drs. Martin R. Meisler and Jack M. Engle, from the museum, Dr. Kathy Ann Miller, University of California herbarium, and Mr. Robert Van Syoc, Cali-

fornia Academy of Sciences.

Dr. Robert J. Lavenberg was funded in March 1988 by the California Department of Fish and Game for a one-year project to study reproduction in sea basses (*Paralabrax*) to determine time of spawning, fecundity, and spawning frequency in kelp bass, spotted bass, and sand bass. In January he traveled to the National Museum of Natural History, Washington, D.C., and the Museum of Comparative Zoology at Harvard University to examine the fishes collected in the eastern Pacific by the *Albatross* in the 1890s.

Dr. James H. Petersen attended the symposium "Frontiers of Marine Ecosystem Research" held at the American Association for the Advancement of Science meeting in Boston in February. He also met with Drs. Saul Salla, University of Rhode Island, and Lev Ginzburg, State University of New York, to continue his collaborations on population modeling of fish and kelp, studies that are sponsored by the southern California Edison Company.

Jeffrey A. Seigel, Collection Manager, continued his public programs lectures, presenting the results of his participation in the Research Vessel *Atlantis II* deep submersive cruise.

Dr. Camm C. Swift was funded in January by the California Department of Fish and Game for a one-year study to assess the status of native freshwater fishes of coastal southern California and the tide-water goby (*Eucyclogobius newberryi*). Dr. Swift attended the American Fisheries Society meeting (California-Nevada chapter) in Ventura where he spoke on his studies on native southern California fishes.



Dick Meier

Dr. Joel W. Martin

Dr. Joel W. Martin, New Curator of Invertebrates. Dr. Joel W. Martin is the Natural History Museum's new Assistant Curator of Invertebrates. His curatorial duties will focus on the museum's collections of marine and fresh-

water Crustacea, the second largest such collection in the United States. Dr. Martin's research centers on the morphology and evolutionary relationships of marine crabs, shrimps, and lobsters. In addition he has worked extensively with and published articles and book chapters on the planktonic larval stages of crabs, development in the Crustacea, and freshwater South American lobsters. His recent work, supported by a grant from the National Science Foundation, is an investigation into the relationships among the small crustaceans, such as fairy shrimp, clam shrimp, and tadpole shrimp, that inhabit temporary freshwater pools in North, South, and Central America.

Dr. Martin received his Bachelor of Science from the University of Kentucky, his Master of Science from the University of Southwestern Louisiana, and his Doctorate in Biological Science from Florida State University.



Dick Meier

Donald W. McNamee

Donald W. McNamee: The Museum's New Chief Librarian. Donald W. McNamee, formerly Head of Cataloguing Services at the California Institute of Technology, has been appointed head of the museum's Research Library.

Mr. McNamee, a native of Los Angeles (indeed, so much so that he lives in a home designed by one of his uncles in 1913), graduated from the USC with a degree in zoology. Following military service and research positions at Scripps Clinic and the UCLA Medical Center, he returned to USC to obtain a Master's degree in library science. While at Cal-Tech Mr. McNamee directed the conversion of the classification scheme to the Library of Congress system, introduced and implemented OCLC online cataloging services, and established a special collections unit.

His outside interests include the study and collection of antiques, especially pottery and porcelain, collecting stamps, and indulging in a life-long addiction to Gilbert and Sullivan.

A Unique Museum Reproduction



Casts of an adult saber-toothed cat skull are for sale at the George C. Page Museum Shop. The saber-toothed cat, *Smilodon californicus*, is the California state fossil. This lion-size carnivore lived during the last Ice Age and became extinct about 10,000 years ago. Many hundreds of *Smilodon* specimens have been recovered from the Rancho La Brea asphalt deposits (tar pits) in

Hancock Park. Our reproduction is cast from a real skull and is made of hand-painted resin mounted on a wooden base. This unusual item is priced at \$225. Other Ice Age mammal fossil reproductions are available, and mail and telephone orders will be accepted.

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George C. Page
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5801 Wilshire Boulevard
Los Angeles, CA 90036
(213) 931-5273



Natural History Museum of Los Angeles County
900 Exposition Boulevard, Los Angeles, CA 90007